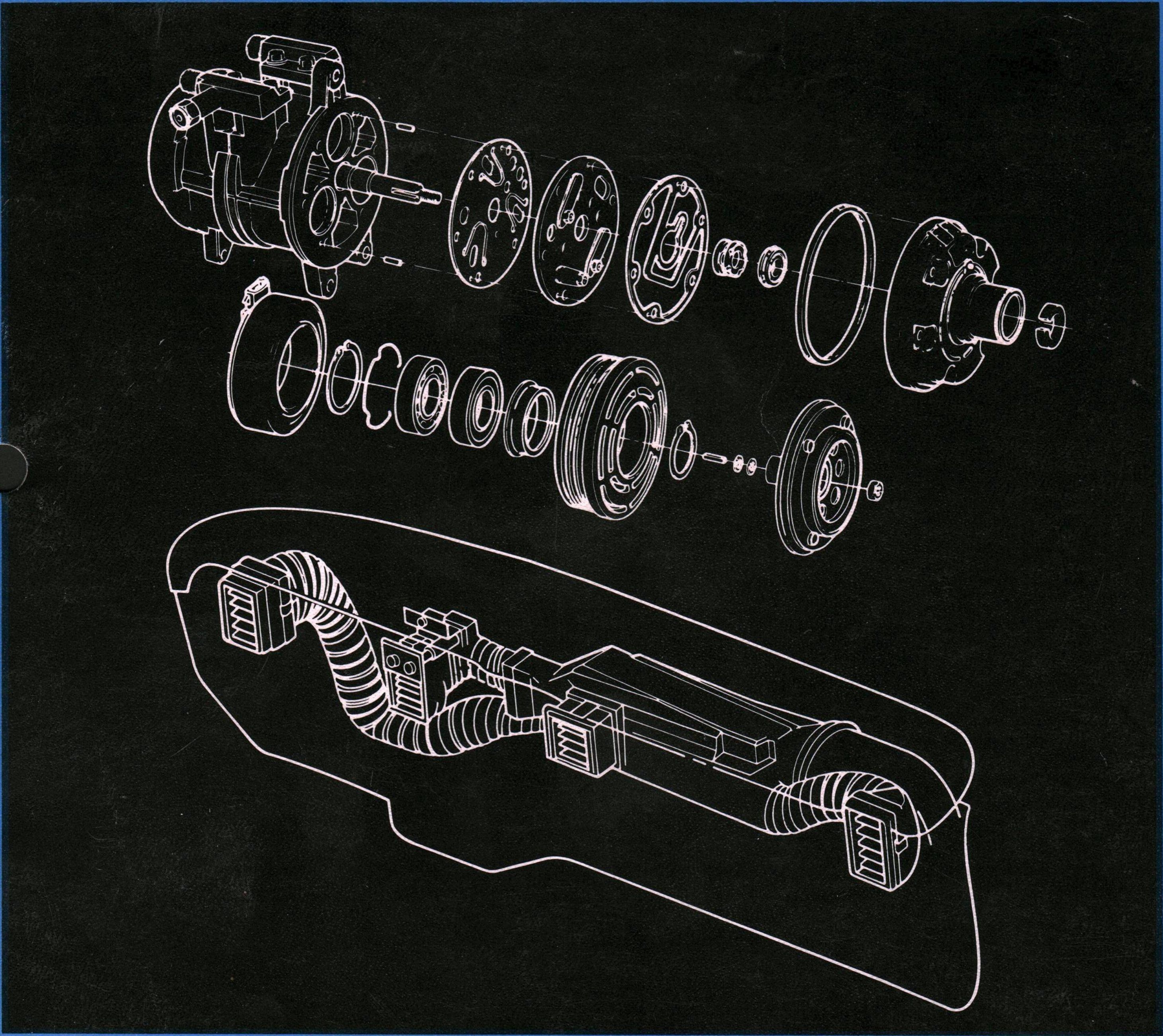
COMPRESSOR/CLUTCH OVERHAUL FORD DEALER INSTALLED A/C SYSTEMS



Ford Parts and Service Division
Training and Publications Department

IMPORTANT SAFETY NOTICE

Appropriate service methods and proper repair procedures are essential for the safe, reliable operation of all motor vehicles as well as the personal safety of the individual doing the work. This manual provides general directions for accomplishing service and repair work with tested, effective techniques. Following them will help assure reliability.

There are numerous variations in procedures, techniques, tools, and parts for servicing vehicles, as well as in the skill of the individual doing the work. This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this manual must first establish that he compromises neither his personal safety nor the vehicle integrity by his choice of methods, tools or parts.

As you read through the procedures, you will come across NOTES, CAUTIONS, and WARNINGS. Each one is there for a specific purpose. NOTES give you added information that will help you to complete a particular procedure. CAUTIONS are given to prevent you from making an error that could damage the vehicle. WARNINGS remind you to be especially careful in those areas where carelessness can cause personal injury. The following list contains some general WARNINGS that you should follow when you work on a vehicle.

- Always wear safety glasses for eye protection.
- Use safety stands whenever a procedure requires you to be under the vehicle.
- Be sure that the ignition switch is always in the OFF position, unless otherwise required by the procedure.
- Set the parking brake when working on the vehicle. If you have an automatic transmission, set it in PARK unless instructed otherwise for a specific service operation. If you have a manual transmission, it should be in REVERSE (engine OFF) or NEUTRAL (engine ON) unless instructed otherwise for a specific service operation.
- Operate the engine only in a well-ventilated area to avoid the danger of carbon monoxide.
- Keep yourself and your clothing away from moving parts, when the engine is running, especially the fan and belts.
- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.
- Do not smoke while working on the vehicle.
- To avoid injury, always remove rings, watches, loose hanging jewelry, and loose clothing before beginning to work on a vehicle. Tie long hair securely behind the head.

NOTE: The recommendations and suggestions contained in this manual are made to assist the dealer in improving his dealership parts and/or service department operations. These recommendations and suggestions do not supersede or override the provisions of the Warranty and Policy Manual and in any cases where there may be a conflict, the provisions of the Warranty and Policy Manual shall govern.

The descriptions, testing procedures, and specifications in this manual were in effect at the time the manual was approved for printing. Ford Motor Company reserves the right to discontinue models at any time, or change specifications, design or testing procedures without notice and without incurring obligation.

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FOREWORD

This reference manual covers Ford Parts & Service Division training material on:

- Automotive Air Conditioning Compressors and Clutches
- Ford Dealer Installed Air Conditioning Systems
- Competitive Air Conditioning Systems

Its purpose is to provide general component information as well as familiarization with basic testing and servicing procedures.

First, the five commonly used **Ford** compressors and their clutch assemblies are discussed in detail; serviceable components are identified, and basic removal/replacement, disassembly/assembly, and testing procedures are explained.

Second, the two types of dealer installed air conditioning systems (integrated and recirculating)—their components and controls, the installation kits required to install them, and the fundamentals of diagnosing and servicing such systems.

Finally, the Competitive Air Conditioning Systems presentation provides design feature highlights for GM, Chrysler, and AMC installations.

IMPORTANT

Because of the potential hazards involved in the handling of the special refrigerant used in automotive air conditioner systems, it is important to carefully observe all the CAUTIONS and WARNINGS, cited in the Manual, against the use of specific service methods that could not only damage a vehicle, but cause serious injury to service personnel.

It is also important to use all special tools (and only these tools) recommended for each particular service operation, in order that both vehicle and personnel safety will be assured.

Please review the Important Safety Notice which appears on the inside front cover.

COMPRESSORS AND CLUTCHES

Introduction

The five compressors most commonly used in Ford automotive air conditioning systems are: York, Tecumseh, Ford FS-6, Nippondenso, and Frigidaire. Although they differ from one another physically, they all function by means of reciprocating pistons and reed valves.

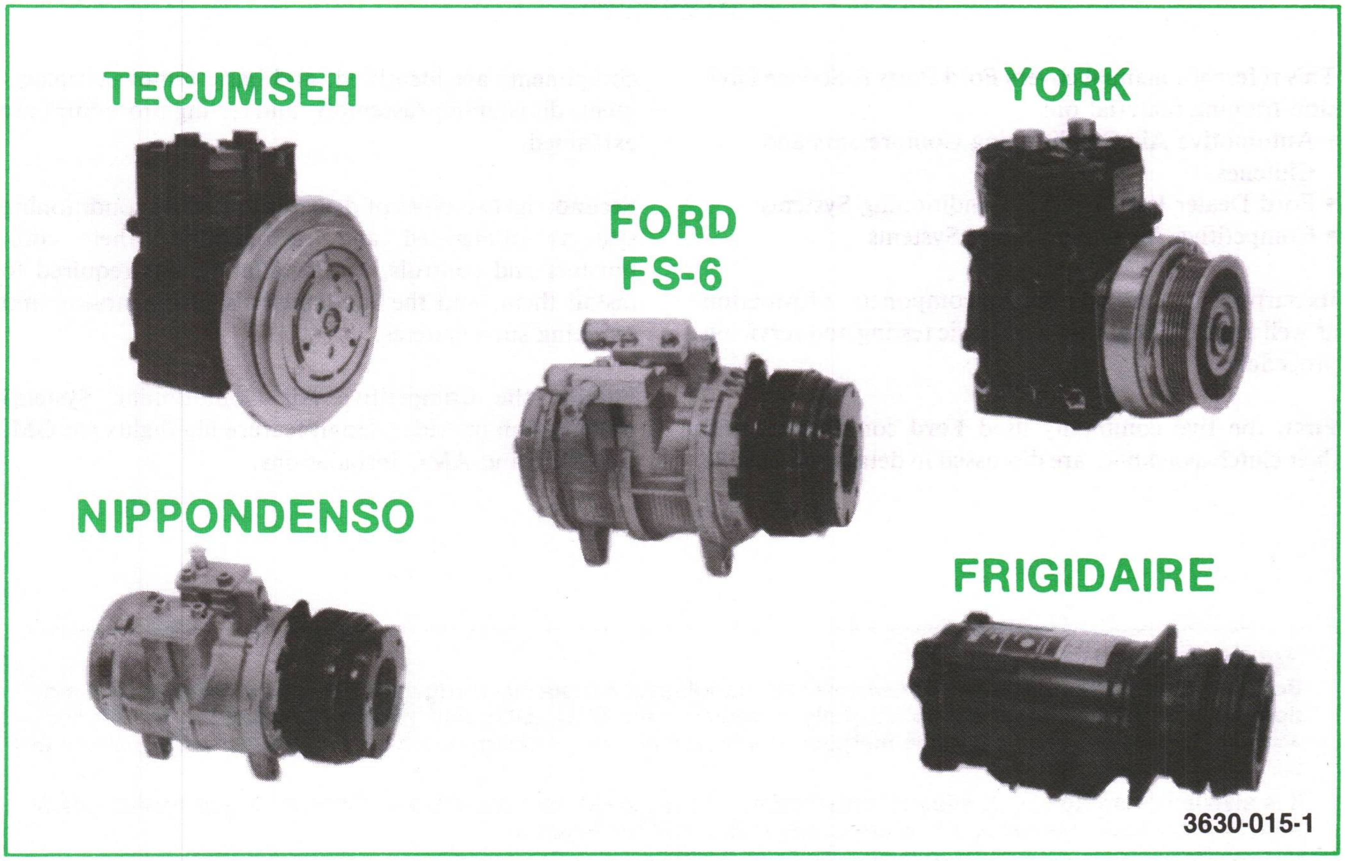

Fig. 1—Compressors Commonly Used by Ford

Characteristics of the Five Commonly-used Compressors

York

- In-line, 2-cylinder design
- Aluminum head and block
- Suction and discharge fittings located in compressor head
- Service valves (on some models) located in compressor head
- Mounts vertically, horizontally, or at any position in between

Serviceable components include:

- Valve plate and gasket
- Head gasket
- Crankshaft seal assembly
- Clutch pulley, bearing and field coil

Tecumseh

- In-line, 2-cylinder design
- Similar to York in appearance and operation
- Cast-iron block and head
- Suction and discharge fittings, and manual valves located in compressor head
- Mounts vertically, horizontally, or at any position in between

Serviceable components include:

- Valve plate and gasket
- Head gasket
- Crankshaft seal assembly
- Clutch pulley, bearing and field coil

Frigidaire
- Steel body, axial 6-cylinder design
- Three sets of double-acting pistons, actuated by a swash plate
- Cylinders have reed-valves at each end of compressor
- Inlet and discharge fittings at rear of compressor
- Gear-type oil pump lubrication

Serviceable components include:
- Shaft seal, seat and sleeve
- Front and rear compressor heads
- Oil pump gears
- All O-ring seals
- Suction screen
- Front and rear suction reeds
- Cylinder and shaft assembly (includes pistons)

Nippondenso
- Aluminum body, axial 6-cylinder design
- Three sets of double-acting pistons, actuated by a swash plate
- Reed-type suction and discharge valve mounted in valve plates at each end of compressor
- Suction and discharge fittings in a top-mounted "block type" refrigerant manifold
- Serviceability is limited to compressor clutch assembly components or complete compressor and clutch replacement

Ford FS-6
- Aluminum body, axial 6-cylinder design
- Reed-type suction and discharge valves at each end of compressor
- Similar to Nippondenso in design and operation but much more serviceable

Serviceable components:
- Manifolds
- Shaft seal
- Heads
- Head gaskets
- O-rings
- Valve plates
- Inlet reeds

Diagnosing the Need to Service the Compressor and Related Components

Noisy compressor operation, loss of cooling performance or leakage at the crankshaft seal are the main indicators of the possible need to service or replace a compressor. These conditions may exist together or independently.

The following should be checked to help rule-out or isolate the compressor as the source of the problem:
1. Drive belt condition
2. Clutch engagement
3. Clutch lead connection(s)
4. Clutch slippage
5. Fuse is good
6. In-vehicle electrical connections
7. Refrigerant pressures
8. Clutch cycle time (on fixed orifice pressure cycling systems)
9. Power steering pressure switch (FWD only)
10. Power brake timer relay (FWD only)
11. A/C relay or clutch isolation relay (FWD only)

An accumulation of oil at the front of the compressor may indicate a leaking compressor shaft seal, if **excessive** oil is present. A small amount of weepage past the seal is normal, however, and will show up as oil streaks on the front of the compressor.

Basic Removal and Installation Procedures

I. Removing the Compressor

NOTE:
In some installations, before the compressor can be removed it may be necessary to disconnect or remove other components not related to the air conditioning system. For details, refer to the Shop Manual for the vehicle being serviced.

1. Using a manifold gauge set, **slowly** discharge refrigerant from the system—low pressure side first, then from the high pressure side. A slow discharge rate is mandatory to minimize the loss of refrigerant oil. Vent the discharge to the outside through a service bay exhaust outlet. If the vehicle is equipped with manual valves, discharging is not necessary. Front seat the manual valve to isolate the compressor.

NOTE:
In some installations, clutch removal and repair can be performed without removing the compressor from the vehicle. Discharging the refrigerant is **not** necessary for in-vehicle clutch repair.

2. Disconnect refrigerant hoses and clutch wiring.
3. Loosen and remove the compressor drive belt.
4. Remove compressor mounting bolts and carefully lift the unit from the mounting brackets.
5. Drain and measure the amount of oil remaining in the removed compressor.

II. Preparing the New Compressor

Adjust the oil level in the new compressor according to the following guidelines.

IMPORTANT
Always keep refrigerant oil tightly capped when not in use. Left open, it will absorb moisture from the air which will then enter the sytem with the new oil.

1. York or Tecumseh:
   a. Adjust the amount of oil in the new compressor to the same amount that was present in the old compressor, but do not exceed the minimum level mark on the dipstick, see chart in Fig. 2.
   b. Obtain or fabricate a rod or dipstick as described in Fig. 2.
   c. Use 500 viscosity oil (C9AZ-19577-B, Motorcraft YN-2, or equivalent).

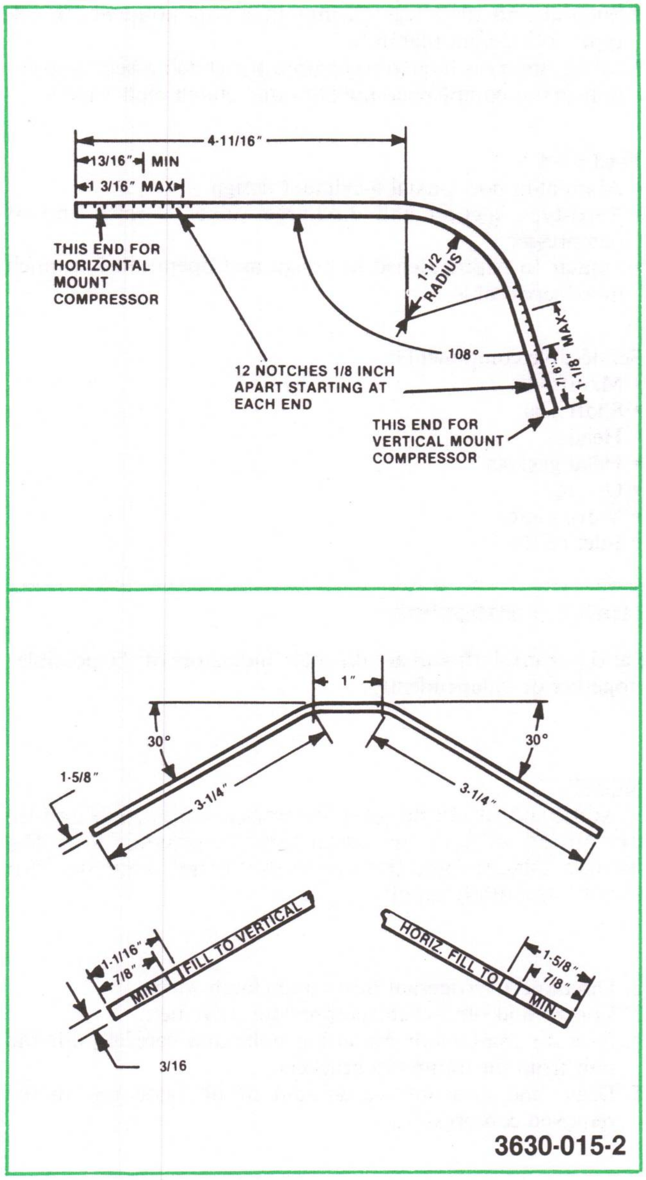

Fig. 2—Compressor Oil Level Dipsticks

Description	Vertical	Horizontal
Tecumseh³ (11 Fluid Ounces)	7/8 Inch Min. 1-1/16 Inch Max.	7/8 Inch Min. 1-5/8 Inch Max.
York³ (10 Fluid Ounces)	7/8 Inch Min. 1-1/8 Inch Max.	13/16 Inch Min. 1-3/16 Max.
Driven Belt Tension (Between Fan Pulley and Air Conditioner Compressor):		
New	140 lbs.	
Used²	110 lbs.	
Minimum²	90 lbs.	
Belt Tension Tool	T63L-8620-A	
Compressor Clutch Run-Out	1/32 Inch Max.	

¹Use Specification ESA-M2C31-A, Ford Part No. C9AZ-19577-B or equivalent.

²Belt Operated for a Minimum of 10 Minutes is Considered a Used Belt.

³Do not add oil if dip stick indicates proper level of oil between minimum and maximum.

If dip stick is below minimum level, add oil up to minimum oil level only.

Fig. 3—Compressor oil capacities and specifications

2. Nippondenso or Ford FS-6:

NOTE:
Draining oil—FS-6 through suction and discharge ports Nippondenso from drain plug at bottom of compressor. Filling oil—FS-6 and Nippondenso through the suction or discharge port

a. For 3 to 6 oz. of oil drained from the removed compressor, adjust the quantity of new refrigerant oil to an identical amount.
b. Under 3 oz. drained from removed compressor—adjust the quantity of new refrigerant oil to 6 oz.
c. Over 6 oz. drained from removed compressor—adjust the quantity of new oil to no more than 6 oz.
d. Use 500 viscosity oil (C9AZ-19577-B, Motorcraft YN-2, or equivalent).

3. Frigidaire:

a. Between 4 and 6 oz. drained from removed compressor—adjust the quantity of new refrigerant oil to an identical amount.
b. Under 4 oz. drained from removed compressor—adjust the quantity of new refrigerant oil to 6 oz.
c. Over 6 oz. drained from removed compressor—adjust the quantity of new refrigerant oil to, but not over, 6 oz.
d. Use TL4538 Texaco 525 viscosity oil, DIVY-19577-A, Motorcraft YN-4, or equivalent.

Leak test the compressor and install the clutch and pulley before installation in the vehicle. Adjust the air gap on FS-6 and Nippondenso compressors before installation in the vehicle.

III. Installing the Compressor

1. Install the compressor to the engine mounting brackets finger tight
2. Re-attach clutch wiring and other components previously disconnected
3. Torque the clutch hub bolt or nut:
   —York/Tecumseh 20-30 ft.-lbs. (27.1-40.7 N·m)
   —Frigidaire 20 ft.-lbs. (27 N·m)
   —Nippondenso 10-14 ft.-lbs. (13-19 N·m)
   —FS-6 10-14 ft. lbs. (13-19 N·m)
4. Torque the compressor mounting bolts
5. Connect the refrigerant lines
6. Evacuate and charge the system, or purge the system if equipped with manual valves.

Two-cylinder Compressor Repair

The 2-cylinder York and Tecumseh compressors both have serviceable head gaskets and valve plates. The procedures for replacing a blown head gasket and replacing a worn valve plate are the same for both compressors.

If a worn valve plate has caused cylinder-wall scoring or the imbedding of metallic debris in the pistons, then the compressor should be replaced.

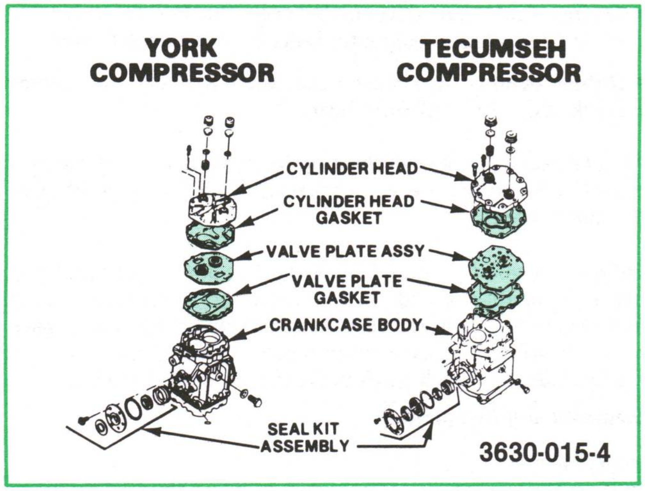

Fig. 4—Disassembled Views of Two-Cylinder Compressors

Torque Limits—Ft-lbs (N·m)		
Description	**Tecumseh**	**York**
Cylinder Head	20-24 (28-32)	15-32 (21-31)
Front Seal Plate	54-78 In-lb (6.10-8.81)	7-13 (11-17)
Service Valve (Tube-0)	20 + 10 (27 + 13)	20 + 10 (27 + 13)
Mounting Bolt	20-30 (28-40)	20-30 (28-40)
Oil Filler Plug	18-22 (25-29)	4-11 (5.5-14)
Clutch Mounting	20-30 (28-40)	20-30 (28-40)
Base Plate	—	14-22 (20-29)
Back Plate	—	9-17 (13-23)
Clutch Coil	6-12 (9-16)	6-12 (9-16)
Quick Disconnect	10-15 (14-20)	10-15 (14-20)

Fig. 5—Bolt Torque Limits Chart

Clutch Assembly

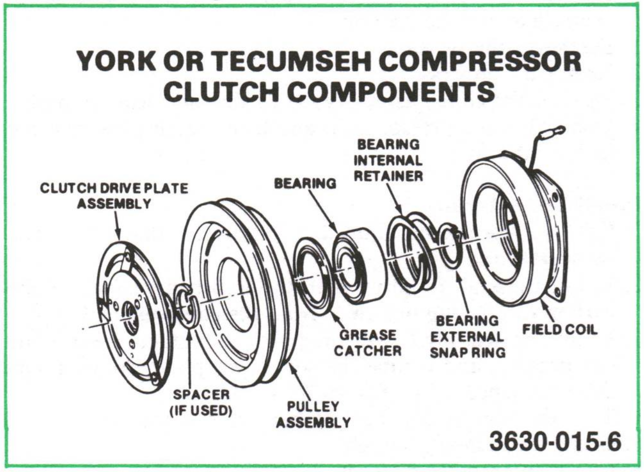
YORK OR TECUMSEH COMPRESSOR CLUTCH COMPONENTS
CLUTCH DRIVE PLATE ASSEMBLY
BEARING
BEARING INTERNAL RETAINER
GREASE CATCHER
BEARING EXTERNAL SNAP RING
FIELD COIL
SPACER (IF USED)
PULLEY ASSEMBLY
3630-015-6

Fig. 6—Two Cylinders Compressor Clutch Components (Typical)

Removal and Installation Procedures

Removal:

1. Hold the clutch drive plate with a spanner wrench (such as T7OP-4067-A or Motorcraft YT-499). When a serpentine drive system is used, it is necessary to hold the clutch flywheel with a strap wrench while removing the clutch bolt, Fig. 7.
2. Loosen and remove the clutch mounting bolt.
3. To loosen the drive plate from the shaft, thread a 5/8-11 bolt into the clutch drive plate. Tighten the bolt while holding the clutch drive plate with a spanner wrench.
4. Loosen and remove the drive belt.
5. Remove the magnetic clutch and pulley assembly from the compressor shaft.

Installation:

1. Clean the compressor shaft and remove any burrs
2. Install the drive key, pulley assembly, spacer, clutch drive plate and mounting bolt.
3. Hold the clutch drive plate with a spanner wrench and torque the mounting bolt 20-30 ft.-lbs. (27.1—40.7 N·m).

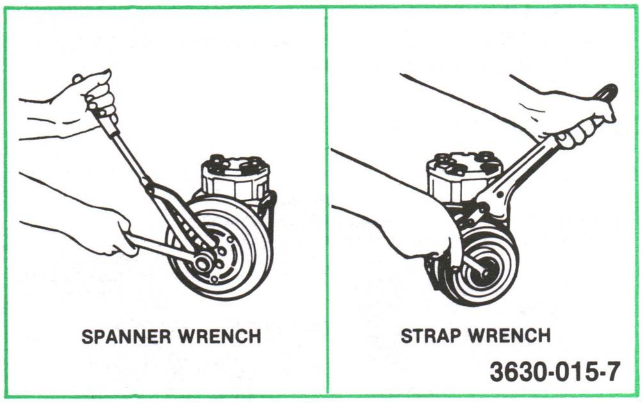

Fig. 7—Removing Clutch Bolt

Compressor Disassembly (York and Tecumseh)

1. Discharge the refrigerant system and remove the compressor from the vehicle.
2. Remove the cylinder head bolts.
3. Remove the valve plate and cylinder head from the compressor by tapping with a fiber hammer.
4. Remove the valve plate from the cylinder head by holding the head and tapping against the valve plate.
5. Remove all particles of gasket, dirt and foreign material from the surface of the cylinder head and cylinder face.

NOTE:
Be extemely careful not to scratch or nick the mating surfaces of any edges.

Compressor Assembly

1. Apply a thin film of clean refrigerant oil to each side of the valve plate and cylinder head gaskets.
2. Place the gaskets, valve plate and cylinder head into position.
   - —York: Has guide pins to aid in assembly.
   - —Tecumseh: Requires the alignment of a stamped letter S on the valve plate with the word SUCTION on the compressor body and the cylinder head. The largest hole in the head gasket must align with the largest hole of the valve plate.
3. Install the compressor head bolts—
   York and Tecumseh compressors have a total of twelve bolts (on factory-air installations) attaching the head to the compressor. Four of these bolts are 12 point and eight are hex head with the 12 point bolts located closest to the suction and discharge connections. On York compressors, two of these bolts may be longer than the others, and should be installed in the holes closest to the center of the head. If flange-type suction and discharge fittings are used, four of the bolts may be longer.

4. Tighten all the bolts until they contact the cylinder head.
   - —York: Torque the two center bolts 15-23 ft.-lbs. (20-31 N·m). Then torque the remaining bolts diagonally opposite each other 15-23 ft.-lbs. (27-31 N·m)
   - —Tecumseh: Torque the bolts diagonally opposite each other 20-24 ft.-lbs. (27-31 N·m)
5. **Wait ½ hour**—then retorque the head bolts in the same sequence and to the same torque as when first tightened.
6. Inspect the top of the cylinder head suction and discharge ports to be sure that they are free of nicks and imperfections
7. Check the compressor oil level and add or remove oil as required
8. Perform a compressor leak test
9. Install the clutch and pulley
10. Connect the suction and discharge lines with new O-rings to the correct compressor ports and torque to specification
11. Evacuate and charge the system.

Compressor Shaft Seals

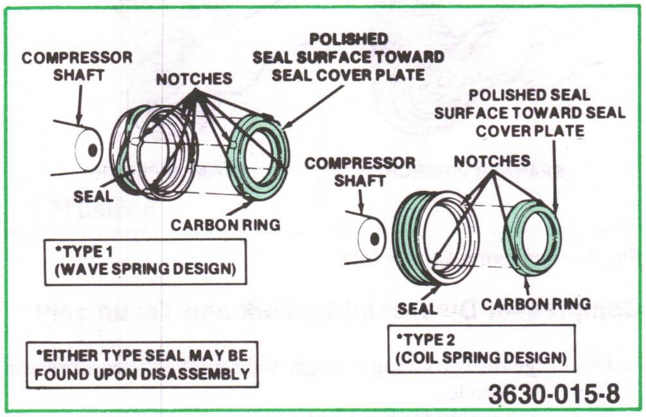
COMPRESSOR SHAFT
NOTCHES
POLISHED SEAL SURFACE TOWARD SEAL COVER PLATE
SEAL
CARBON RING
*TYPE 1 (WAVE SPRING DESIGN)
POLISHED SEAL SURFACE TOWARD SEAL COVER PLATE
COMPRESSOR SHAFT
NOTCHES
SEAL
CARBON RING
*TYPE 2 (COIL SPRING DESIGN)
*EITHER TYPE SEAL MAY BE FOUND UPON DISASSEMBLY
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Fig. 8—Two Cylinder Compressor Shaft Seals

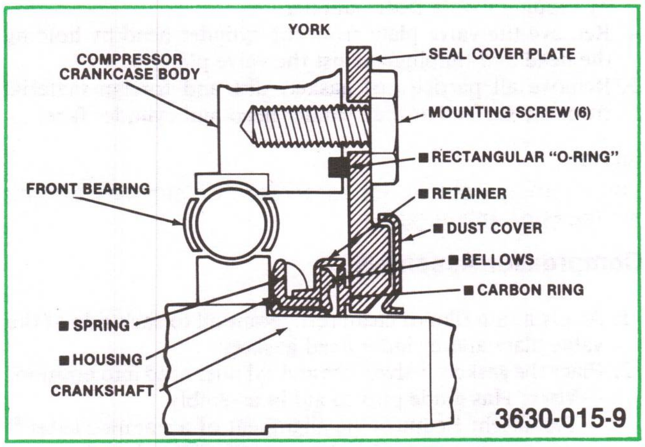


Fig. 9—Common Seal Leak Points

The two types of compressor shaft seals used in production are illustrated in Fig. 8. Replacement seals are of the coil-spring design, and are the approved replacement part for either type of production seal.

Seal Leakage.

Leakage of refrigerant vapor from the seal area commonly occurs at three points:

- **Carbon ring**—a slight amount of weepage between the carbon seal surface and seal plate is normal.
- O-ring—leaks can develop between the O-ring and cover plate due to loose seal plates bolts or a damaged O-ring.
- **Rubber bellows**—leaks can occur when the bellows becomes cracked or distorted from heat.

Normal seal weepage will show up in the form of oil streaks on the front of the compressor, and, possibly, a few drops of oil in the clutch area.

Oil spray beyond the clutch area, on the compressor mounting brackets, or on the underside of the hood indicates excessive leakage, and suggests the need for seal replacement. Oil leakage normally will not be evident on 6-cylinder compressors due to the head design which helps prevent visible oil throwing.

Removal and Installation

CAUTION:
The refrigerant system must be discharged before loosening the seal plate screws.

NOTE:
The replacement seal usually comes packaged with the polished surface of the carbon ring turned toward the seal for protection.

When installing the seal assembly, make sure that the carbon ring notches engage the retainer tabs, and **that the polished seal surface points away from the compressor body and mates with the polished side of the seal plate,** Fig. 8.

NOTE:
Care must be taken not to touch the polished surfaces of the carbon ring or seal plate.

Removal:
In most cases it is preferrable to remove the compressor from the vehicle to replace the seal.

1. Discharge the system.
2. Removal compressor.
3. Remove the clutch assembly, drive key, and seal assembly.
4. Inspect the compressor shaft and front bearing journals for nicks and burrs.

Installation—Tecumseh:

1. Coat the new seal assembly and compressor shaft with clean refrigerant oil.
2. Install the seal assembly **with the polished surface of the carbon ring facing out away from the compressor,** Fig. 8.
3. Install the seal plate with the polished surface towards the compressor, and torque the seal cover plate screws in circular sequence 5-7 ft.-lbs. (6.7-9.5 N·m)
4. Turn the compressor shaft by hand to seat the seal.
5. Install the magnetic clutch.
6. Check compressor oil level.
7. Install compressor in vehicle.

Installation—York:

1. Coat the new seal assembly and compressor shaft with clean refrigerant oil.
2. Install the seal assembly **with the polished surface of the carbon ring facing out, away from the compressor.** Move seal in and out on the shaft to ensure a good seal.
3. Install the seal plate with the polished surface towards the compressor, and tighten the screws diagonally while turning the compressor shaft. Clearance between the hole in the retainer plate and the shaft must be even all the way around.

4. Torque the screws 5-7 ft.-lbs. (6.7-9.5 N·m).
5. Install the magnetic clutch and drive belt.
6. Check compressor oil level.
7. Install compressor in vehicle.

NOTE:
Broken parts or metal particles found when the compressor is disassembled will necessitate the following:

1. Replacement of
   —the compressor
   —the receiver/drier assembly
   —The liquid line filter (found near the condenser on '80-'81 F-Series and Bronco's).
2. A complete system flush-out.

The Frigidaire Compressor

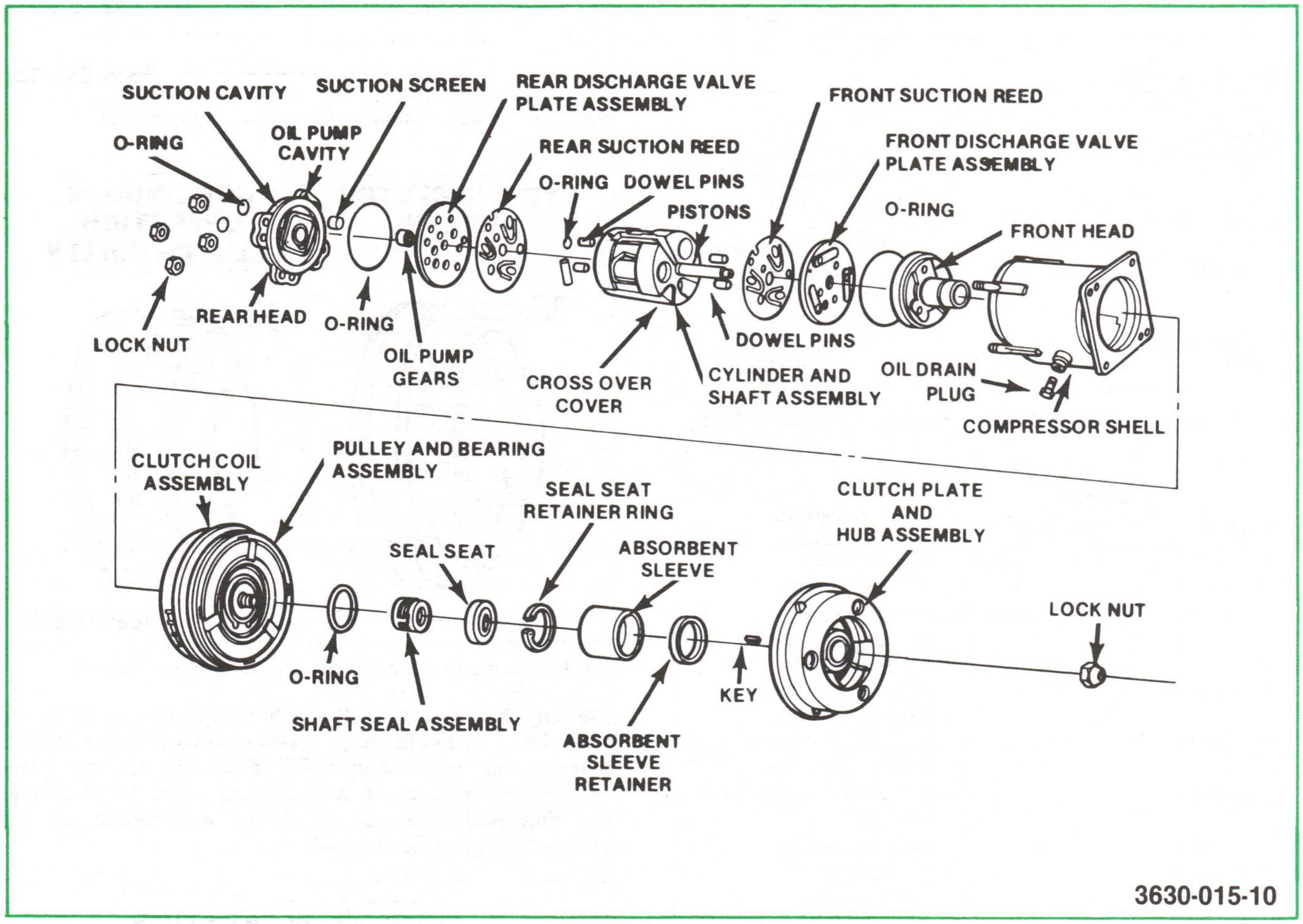


Fig. 10—Frigidaire Compressor Disassembled View

Six-Cylinder Compressor Repair

The Frigidaire compressor can be disassembled for inspection, and repair or replacement of many components. Serviceable items include:

- Rear compressor head
- Oil pump gears
- All O-ring seals
- Front and rear valve and reed plate assemblies
- Front compressor head
- Cylinder and shaft assembly (includes pistons)
- Suction screen
- Shaft seal, seat and sleeve

If the compressor has been damaged to the extent that it will not turn, it should be replaced; however, the clutch, if usuable, can be retained and installed on the new compressor.

NOTE:
Broken parts or metal particles found when the compressor is disassembled will necessitate the following:

1. Replacement of
    - the compressor
    - the receiver/drier assembly
    - the fixed orifice tube (on fixed orifice systems)
2. A complete system flush-out. (Only a partial flush on fixed orifice systems.)

REFRIGERANT

High Pressure Relief Valve (Located in hose assy manifold attached to compressor)	3108 kPa (450 psi)
Type Refrigerant 12 (R-12)	Ford D4AZ-19B519-A Motorcraft YN1-A 14 Oz Can YN-7 30 Lb Container

COMPRESSOR—6 CYLINDER

Type—Swash Plate—Three Double Acting Pistons—Axial Type	
Displacement	12.6 Cu In
Cylinder Bore	1-1/2 Inches
Stroke	1-3/16 Inches
Rotation	Clockwise
Refrigeration Oil	
Type	TL4538 Texaco 525 Viscosity
Capacity	10-1/2 Fluid Ounces (Ford D1VY-19557-B Motorcraft YN-4)
Drive Belt Tension	
New	120-160 Lbs
Used (after operation for 10 minutes or more)	75-120 Lbs

Fig. 11—Frigidaire Compressor Service Specifications Chart

TOOL NUMBERS		DESCRIPTION
ROTUNDA	MOTORCRAFT	
T71P-19703-B	YT450 & YT455	PULLEY PULLER
T71P-19703-C	YT412	"O" RING REMOVER
T71P-19703-D	YT443 & YT444	BEARING AND PULLEY ASSEMBLY REPLACER AND BEARING REMOVER
T71P-19703-E	YT454	CLUTCH PLATE AND HUB ASSEMBLY REMOVER
T71P-19703-F	YT458-A	CLUTCH PLATE AND HUB ASSEMBLY INSTALLER
T71P-19703-G	YT415	SEAL ASSEMBLY REMOVER AND REPLACER
T71P-19703-H	YT484	SHAFT SEAL PROTECTOR
T71P-19703-J	YT460	"O" RING GUIDE
T71P-19703-K	—	"O" RING SLEEVE

TOOL NUMBERS		DESCRIPTION
ROTUNDA	MOTORCRAFT	
T71P-19703-L	YT461	"O" RING AND SNAP RING REPLACER
T71P-19703-M	YT486	CERAMIC SEAL REMOVER AND REPLACER
T71P-19703-N	YT411	FELT SLEEVE RETAINER REPLACER
T71P-19703-P	YT213 or YT233	TOOL BOX
T71P-19703-Q	YT389	PRESSURE TEST PLATE
T71P-19703-R	YT214	90° ADAPTER
T71P-19703-S	YT274	STRAIGHT ADAPTER
T71P-19703-T	YT425	SNAP RING TOOL
T70P-4067-A	YT344 or YT499	CLUTCH SPANNER WRENCH
T57L-500-A	YT465	HOLDING FIXTURE

Fig. 12—Frigidaire Compressor Special Tools Chart

Clutch Assembly

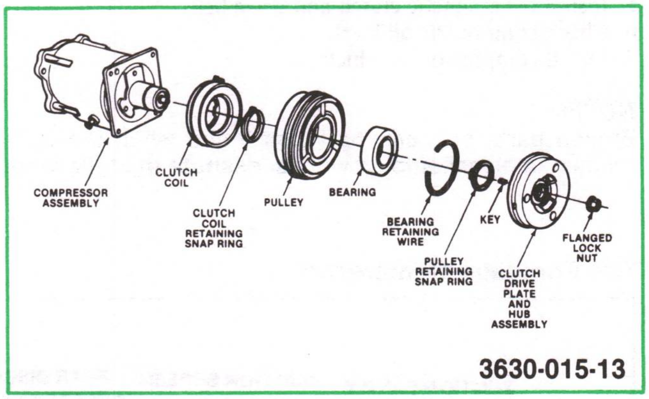


Fig. 13—Frigidaire Compressor Clutch Components

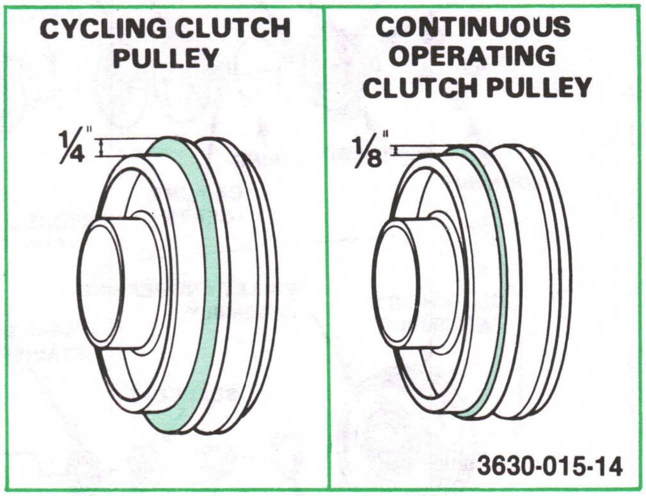


Fig. 14—Comparison of Frigidaire Compressor Pulleys

Use only the **"new design"** clutch pulley when replacing the drive clutch on Frigidaire compressors used in a fixed orifice clutch cycling system. This pulley has a larger diameter drive-belt groove to reduce belt shock-loading during clutch cycling. The dimensions shown in Fig. 14 are approximate, and are provided for identification only.

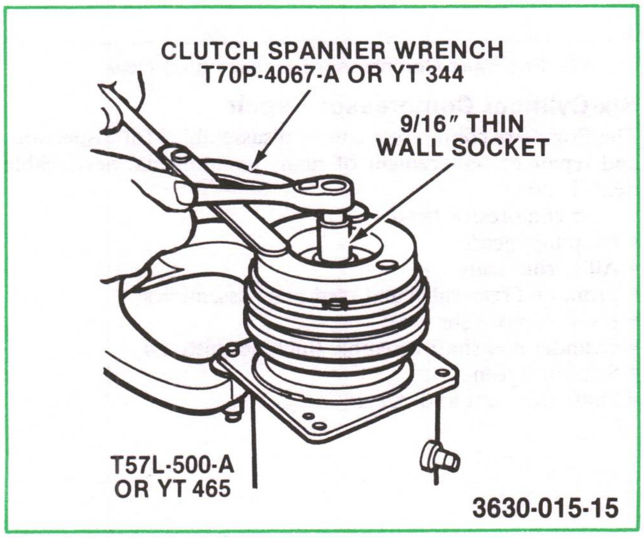


Fig. 15—Removing Clutch Nut

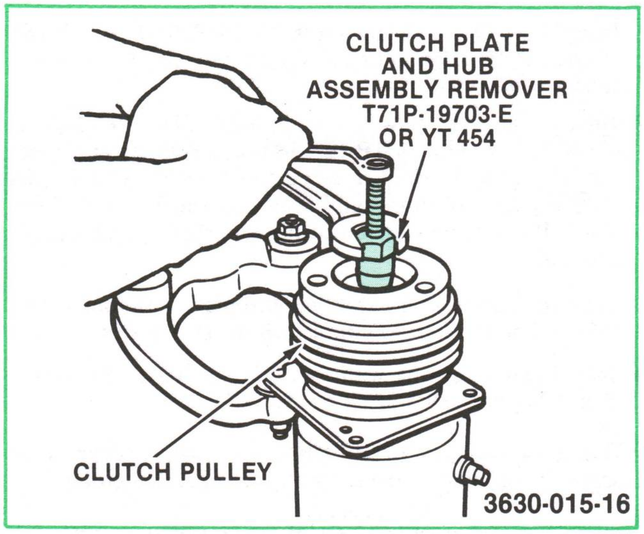


Fig. 16—Removing Clutch Drive Plate and Hub Assembly

Removal

Because of the Frigidaire compressor's shape and weight, repair operations performed on the unit will be made easier if the unit is placed on a repair fixture.

1. Remove the compressor from the vehicle, and clean the compressor.
2. Place the compressor in a bench mounted holding fixture (T57L-500-A or YT465).
3. Remove the clutch lock nut, clutch drive plate, and hub assembly using the tools shown in Fig. 15 and Fig. 16.
4. Remove the pulley by first removing the retaining snap ring and placing tool T71P-19703-N or YT455 over the compressor shaft. Use remover tool T71P-19703-B or YT450 to pull the pulley from the compressor hub as shown in Fig. 17.

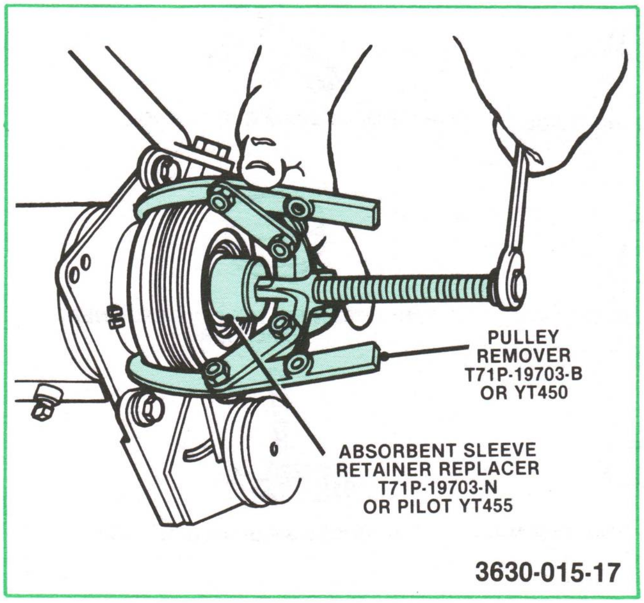


Fig. 17—Pulley Assembly Removal

IMPORTANT:

A. Only a new *flanged* lock nut should be used during reassembly of the clutch to the compressor shaft. This flanged lock nut must be used *without* a spacer/washer otherwise air gap clearance may be adversely affected. Some early models will have a non-flanged nut with a spacer/washer. This should be replaced with the flanged lock nut without the spacer washer.

B. When reinstalling the clutch, check the air gap between the clutch drive plate and hub assembly and the face of the pulley. If not within specifications (0.022"—0.057"), dislocation of the shaft within the swash (wobble) plate should be suspected.

To check compressor shaft position, remove clutch plate and hub assembly. Measure the distance between end of the neck on the compressor front head and the flat shoulder on the shaft (Use a wire gauge). Clearance should be between 0.029"—0.073". If outside these limits, the cylinder and shaft assembly must be replaced.

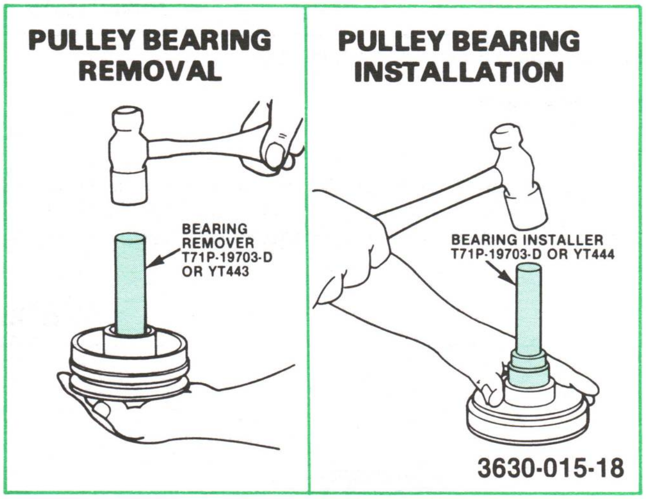


Fig. 18—Pulley Bearing Removal and Installation

Pulley Bearing Removal and Installation

1. Use an awl or small screwdriver to remove the bearing retaining wire.
2. Tool T71P-19703-D is used, Fig. 18, for bearing removal and installation, and for replacing the pulley assembly into the compressor hub (YT443, Remover and YT444, Installer)

Seal Removal

1. Pry out the sleeve retainer with a small screwdriver and remove the absorbent sleeve.
2. Remove the seal seat retainer ring with T71P-19703-T, YT-425 or Snap-On pliers PRA-25.

NOTE:

Thoroughly clean the inside of the compressor neck to prevent any foreign material from entering into the compressor.

3. Remove the ceramic seal by rotating clockwise with tool T71P-19703-M or YT-486 while pulling it out.
4. Remove the O-ring with tool T71P-19703C or YT-412.
5. Insert seal remover/replacer tool T71P-19703G or YT-415. Rotate tool clockwise while pushing down to hook tangs in the seal. Lift tool and seal from the compressor neck.

Shaft Seal Assembly and Seal Seat

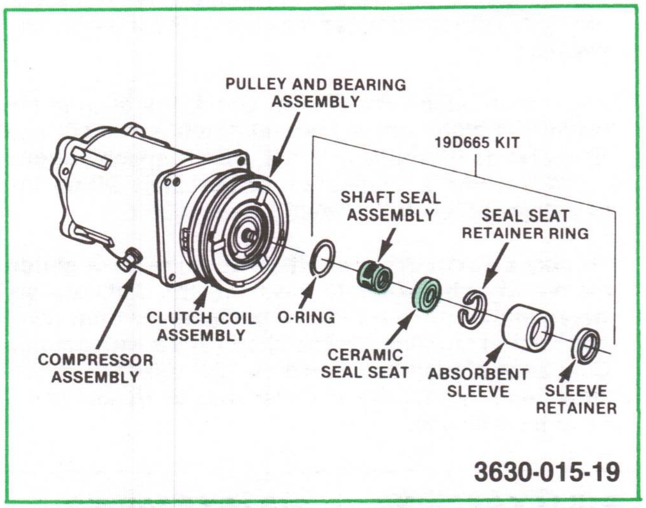


Fig. 19—Shaft Seal and Seal Seat Assembly

Seal Installation

NOTE:
All sealing components of the new seal assembly should be coated with clean 525 viscosity refrigerant oil (DIVY-19577-A or Motorcraft YN-4 or equivalent) before installation.

1. Insert new O-ring using tools T71P-19703-J or YT-462 (guide), T71P-19703-K or YT-451 (sleeve), and T71P-19703-L or YT-460 (installer).
2. Engage tangs of new seal with tool T71P-19703-G or YT-415. Place tool T71P-19703-H or YT-485 (seal protector) on end of the shaft. Insert the seal. Turn the tool while applying light pressure until seal seats on the flats of the shaft. Reverse the rotation of the tool slightly and remove the tool.
3. Carefully push ceramic seal seat into place with tool T71P-19703-M or YT-486 Do not disturb the O-ring seal.
4. Install new snap ring with tool T71P-19703-T, YT-425 or Snap-On pliers PRA-25.
5. If necessary use tool T71P-19703-L or YT-460 to depress the seal enough to allow the snap ring to engage its groove..
6. Perform an external leak test of the compressor shaft seal prior to proceeding with the clutch installation.
7. When a good seal exists, remove the gauge set and complete the seal installation as follows:
   —Install absorbent sleeve. The edges of the sleeve must butt together, not overlap.
   —Install the sleeve retainer with tool T71P-19703-N or YT-461. The retainer is correctly positioned when recessed approximately 1/32 inch from the neck opening.

SPECIAL TOOLS

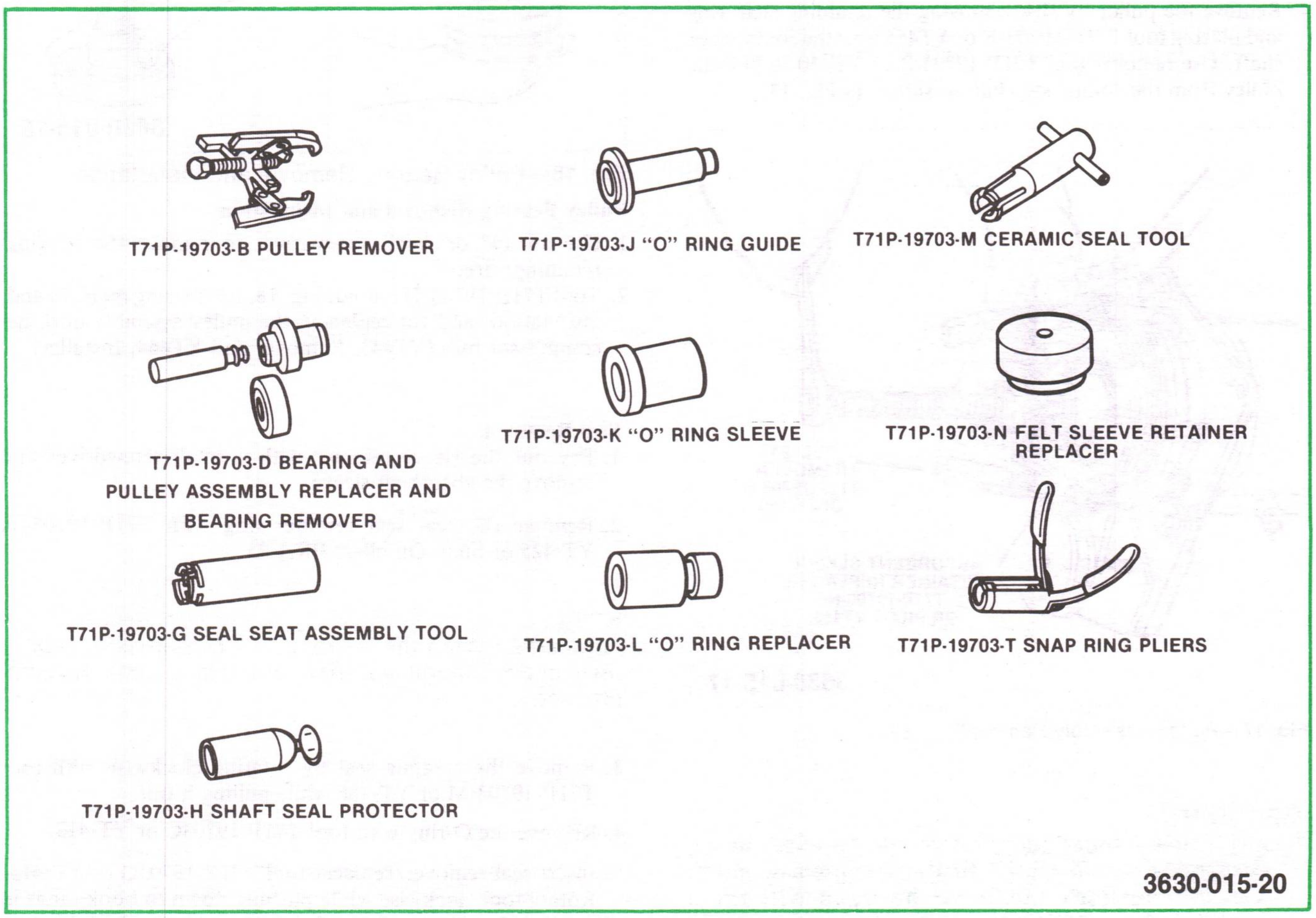

T71P-19703-B PULLEY REMOVER
T71P-19703-J "O" RING GUIDE
T71P-19703-M CERAMIC SEAL TOOL
T71P-19703-D BEARING AND PULLEY ASSEMBLY REPLACER AND BEARING REMOVER
T71P-19703-K "O" RING SLEEVE
T71P-19703-N FELT SLEEVE RETAINER REPLACER
T71P-19703-G SEAL SEAT ASSEMBLY TOOL
T71P-19703-L "O" RING REPLACER
T71P-19703-T SNAP RING PLIERS
T71P-19703-H SHAFT SEAL PROTECTOR
3630-015-20

Fig. 20—Frigidaire Compressor Special Tools

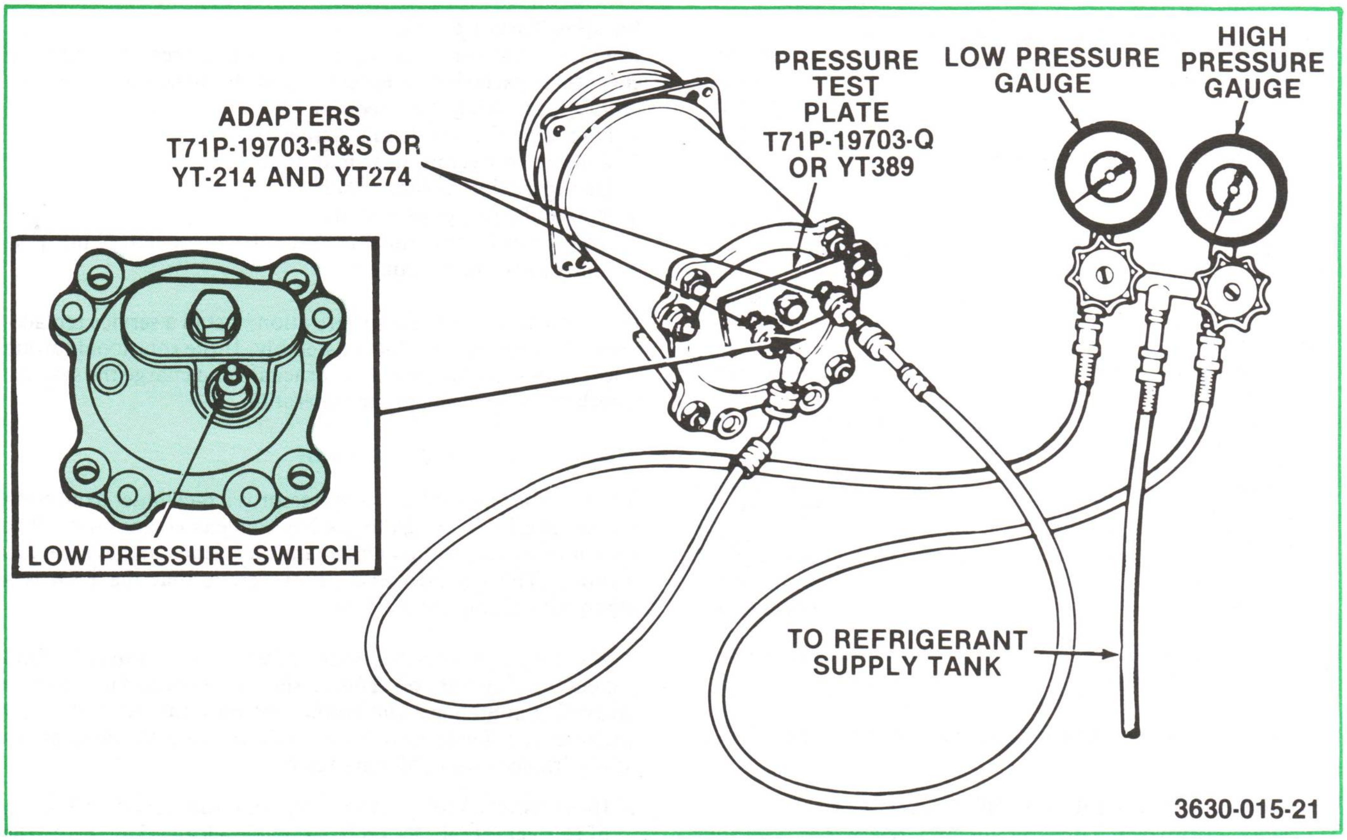


Fig. 21—External Leak Test Hook-Up

External Leak Test

Before installing a new or repaired compressor on a vehicle, an external leak test should be conducted as a precaution.

Two testing methods are possible using the manifold gauge set hook-up shown above:

- Typical pressurized refrigerant ''sniffing''
- Vacuum testing by creating a vacuum within the compressor, shutting all valves, and checking for vacuum loss after a suitable waiting period. If the seals are satisfactory, no noticeable loss of vacuum will have taken place.

In addition to the leak test, the above hook-up can be used for evacuating the compressor or complete system, and for system charging.

Low Pressure Cut-Out Switch Test

The Frigidaire compressors used on some 1979 Lincolns have a low pressure cut-out switch on the rear compressor head which senses low pressure resulting from a low-charge state or low ambient temperature. The ambient switch is not needed and is not used when this clutch cut-out switch is used.

An appropriate time to test the operation of the low pressure cut-out switch would be during the external leak test.

- Connect a self-powered test light between the pin connection in the rear head of the compressor and ground
- The switch should be open when the compressor is discharged, and the light should NOT glow. If it does glow, the switch is shorted and should be replaced.
- The switch should be closed when the compressor is fully charged (above approximately 45 psi) and the self-powered test light should glow. If not, discharge the system and replace the switch.

The Nippondenso Compressor

The aluminum-bodied Nippondenso 6-cylinder compressor is servicable by replacement, only, as individual service parts are not available. A compressor malfunction will require replacement of the complete compressor and clutch assembly. (DO NOT replace the compressor if only the clutch requires servicing.)

Clutch Assembly

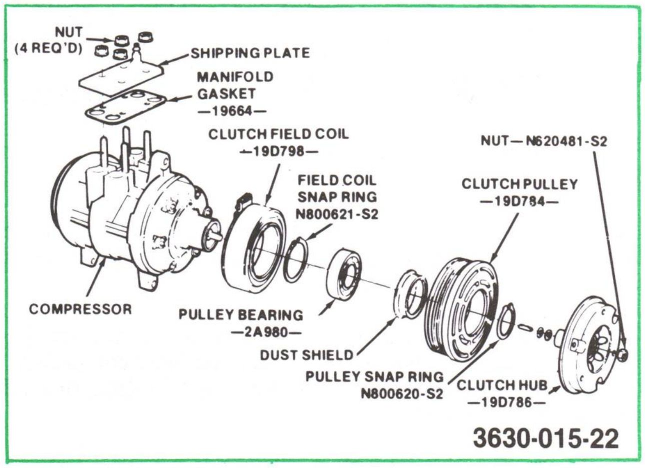


Fig. 22—Nippondenso Clutch Components Disassembled View

TYPE—Swash Plate—Three double acting pistons—Axial Type	
DISPLACEMENT	10.4 CID
CYLINDER BORE (DIA.)	1.4 inch
STROKE	1.2 inch
ROTATION	Clockwise
ROTATIONAL TORQUE (Maximum Manifold Removed)	10 N·m—7 Ft. Lbs.
REGRIGERANT OIL	
Type (Ford Spec)	ESC-M2C31-A—500 Viscosity
Capacity	13 Fluid Ounces
Part Number	C9AZ-19577-B Motorcraft YN-2
DRIVE BELT TENSION	
New	120-160 lbs.
Used (After operation at 10 minutes or more)	75-120 lbs.
MAGNETIC CLUTCH	
Air Gap Between Pulley and Hub	0.021-0.036 inch
Current Draw	4.67 Amps @ 12.8 volts
Run-Out (Maximum)	0.02 inch—Radial or Axial
SPECIAL SERVICE TOOLS	
Hub Remover	T80L-19703-B
Pulley Bearing Replacer	T80L-19703-C
Pulley Support	T80L-19703-E
Hub Replacer	T80L-19703-F
Compressor Shaft Protector	T80L-19703-G
Manifold Test Plate	T80L-19703-H
Pulley Replacer	T80L-19703-J
Pulley Puller	T71P-19703-B
Pulley Puller Center Bolt	T80L-19703-K
Spanner Wrench (Motorcraft)	YT-499

Fig. 23—Nippondenso Specifications and Special Tools Chart

Removing the Clutch-Hub and Pulley Assemblies
The Nippondenso clutch used on this compressor is the same as the one used on the FS-6 compressor. It can be removed and reinstalled using the procedures discribed for the FS-6.

Leak Tests

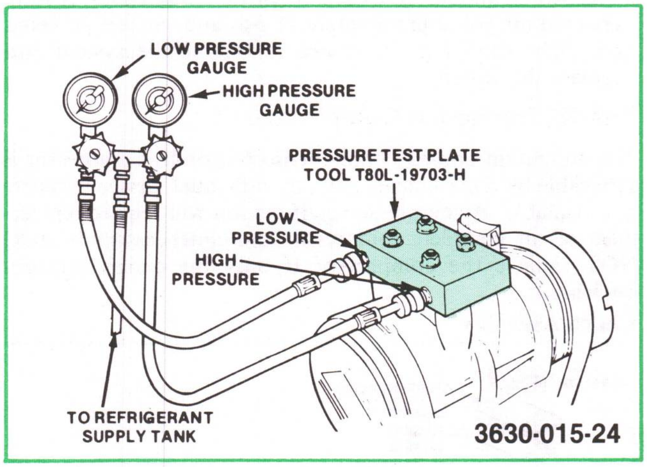


Fig. 24—External Leak Test Hook-Up

Leak tests should be performed before installing a service replacement compressor, of if a compressor seal leak is suspected.

Fig. 24 shows the proper manifold gauge set connections for conducting an external leak test of a Nippondenso compressor. To check for leaks, open all valves, and use a leak detector at all seal and joint locations.

Should the test indicate a leak, the compressor and clutch assembly must be replaced.

Rotating Torque Check
Rotational torque of a Nippondenso compressor should be checked if excessive compressor drag is suspected. The procedure for making this check is:

1. Discharge the refrigerant system
2. Remove refrigerant hose manifold
3. Disengage compressor clutch
4. Rotate the compressor shaft
5. Rotational torque must not exceed 7 lb.-ft. (10 N·m). (Do not read starting torque.)

If the torque exceeds the specification, install a service replacement compressor and clutch assembly. If the rotational torque is less than specified; leak test, evacuate and charge the system. Check the system for proper operation.

The Ford FS-6 Compressor

The 6-cylinder Ford FS-6 compressor is a 6-cylinder axial compressor similar in design to the Nippondenso compressor. The FS-6 uses two individual hose manifolds which makes it easy to identify. The big difference, however, is that the FS-6 is a highly serviceable compressor.

A new FS-6 service replacement compressor contains 13 fluid ounces of refrigerant oil. This oil should be drained into a clean measuring container. The amount of oil returned to the new compressor prior to installation is determined by the quantity of oil drained from **old** compressor:

1. If the removed (old) compressor contained **less** than 3 fl. oz. of refrigerant oil, pour 6 fl. oz. of the clean oil back into the replacement unit.
2. If the oil drained from the removed compressor measured **between** 3 and 6 oz., intall an **equal** amount of clean refrigerant oil in the service replacement compressor.
3. If the oil drained from the removed compressor measured **more** than 6 fluid ounces, pour **only** 6 ounces of clean oil back into the service replacement compressor. Never install a service replacement compressor with more than 6 fluid ounces of refrigerant oil.

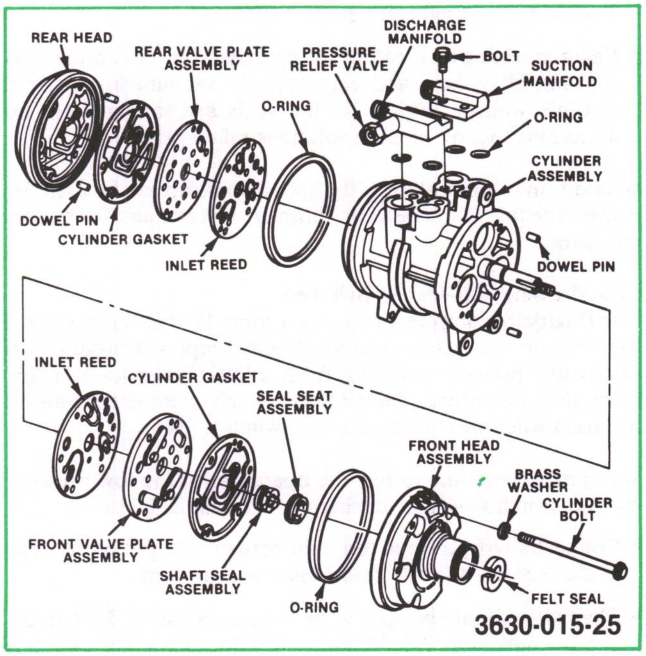


Fig. 25—FS-6 Compressor Disassembled View

DISPLACEMENT	10.4 CID
ROTATIONAL TORQUE (Maximum-Manifold Removed)	7 ft-lbs (10 N·m)
REFRIGERANT OIL	
Type	500 Viscosity
Capacity (New)	13 Fluid Ounces
Part Number	C9AZ-19577-B Motorcraft YN-2
DRIVE BELT TENSION	
New	120-160 lbs.
Used (After operation of 10 minutes or more)	75-120 lbs.
MAGNETIC CLUTCH	
Air Gap Between Pulley and Hub·	0.021-0.036 inch
Current Draw	4.67 Amps @ 12.8 volts
TORQUE LIMITS	
Hose Manifold to Compressor	13-17 ft-lbs (18-23 N·m)
Clutch Hub Nut	10-14 ft-lbs (13-19 N·m)
Compressor Head Bolts	18-21 ft-lbs (24.5-26.5 N·m)
Suction Hose to Manifold	21-27 ft-lbs (28-38 N·m)
Discharge Hose to Manifold	15-20 ft-lbs (20-27 N·m)

	MOTORCRAFT	ROTUNDA
SPECIAL SERVICE TOOLS		
Hub Remover	(YT-1011)	T80L-19703-B
Pulley Bearing Replacer		T80L-19703-C
Hub Replacer		T80L-19703-F
Compressor Shaft Protector		T80L-19703-G
Pulley Replacer		T80L-19703-J
Pulley Puller		T71P-19703-B
Pulley Puller Center Bolt		T80L-19703-K
Complete Pulley Puller		T81F-19623-K*
Spanner Wrench (Motorcraft)	(YT-499)	
Valve Plate Remover		T81P-19623-B*
Shaft Seal Seat Installer		T81P-19623-C*
Support and Clamp Assembly		T81P-19623-D*
Shaft Key Remover		T81P-19623-E*
Pressure Test Fittings		T81P-19623-F*
Shaft Seal Seat Remover		T81P-19623-H*
*Clutch Pulley Support (Nippondenso Clutch) Gold		T81P-19623-J*
Clutch Pulley Support (Warner Clutch) Black		T80L-19703-E

***NEW FOR 1981**

Fig. 26—Service Specifications and Special Service Tools Chart

Clutch Assembly

DISCUSSION

Two different clutch assemblies are used with the FS-6 compressor, depending upon the installation. **NOTE:** Although they will physically fit together, an inoperative or malfunctioning clutch will result from intermixing the components.

WARNER CLUTCH

The upper pictured "Warner Clutch Components" in Fig. 27 are used in 1980 and 1981 Ford, Mercury, Lincoln and Mark cars. They are identified by the method of retaining the bearing in the pulley and the appearance of the drive hub.

The Warner pulley bearing is staked three places, and the pulley is driven by a 6-groove belt. The clutch can be further identified by three rivets, each in a semi-circular pocket in the 1" wide face ring of the clutch hub. This face ring also includes three service holes for inserting the pins of a spanner wrench. The friction plate is attached to the clutch hub by three leaf springs which allow the movement of the friction face into and out of contact with the pulley friction face when influenced by the magnetic force of the field coil.

NIPPONDENSO CLUTCH

The lower pictured "Nippondenso Clutch Components" in Fig. 27 are used in 1981 Escort, Lynx, Ford, Mercury, Lincoln and Mark cars and 1980 vehicles with a Nippondenso compressor. They may have a 5-groove pulley (Escort, Lynx) or a 6-groove pulley (Ford, Mercury, Lincoln, Mark). The positive means of identification is the bearing retainer ring (as opposed to the staked bearing of the Warner clutch) and by the appearance of the drive hub.

The Nippondenso pulley may contain either one or two bearings. However, either design uses a bearing retainer ring. The clutch can be further identified by four rivets attaching the friction plate to the outer clutch hub drive ring. The outer clutch hub ring is attached to the inner clutch hub through a 3/8" wide rubber drive/deflection ring. The rubber ring allows the movement of the friction face into and out of contact with the pulley friction face when influened by the magnetic force of the field coil. The rubber ring also transmits driving force to the compressor shaft from the pulley friction face. A band wrench is best for removing the clutch hub retaining nut.

INTERCHANGEABILITY

The Warner and Nippondenso clutches can be interchanged and operate properly on an FS-6 compressor used in Ford, Mercury, Lincoln and Mark IV vehicles. However the coil must be changed if the pulley is changed from one design to the other.

NOTE:
Installed clearances prohibit the use of the Warner clutch on the Escort/Lynx vehicles.

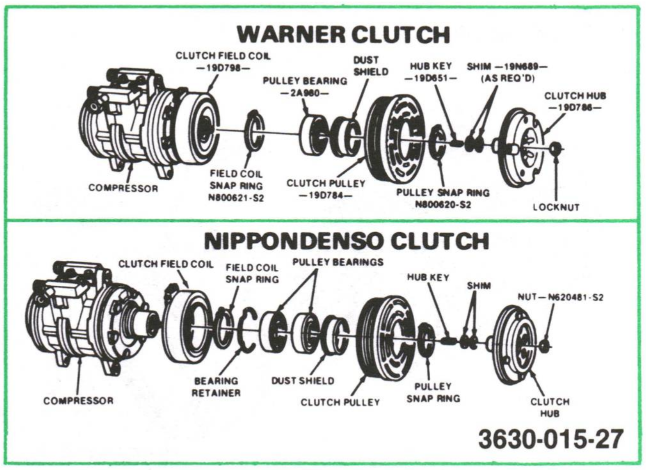
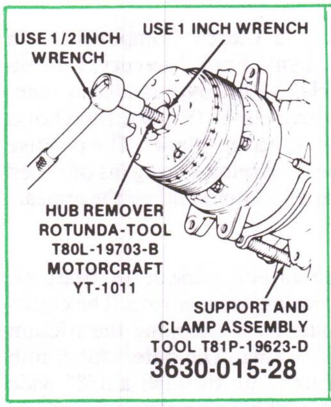


Fig. 27—Warner and Nippondenso Clutch Components

Servicing Clutch Hub and Pulley Assembly

Removing the Clutch Hub and Pulley Assembly

1. The clutch can be serviced in-vehicle on Ford, Mercury, Lincoln and Mark cars after disconnecting the radiator upper hose to provide clearance. It is necessary to remove the compressor from Escort and Lynx vehicles before the clutch can be removed.
2. To remove the hub retaining nut, use a spanner wrench T7OP-4067-A (Motorcraft YT-499) and/or band wrench (Motorcraft YT-1014) to hold the hub while removing the nut.
3. Remove the compressor drive belt.


USE 1/2 INCH WRENCH
USE 1 INCH WRENCH
HUB REMOVER ROTUNDA-TOOL T80L-19703-B MOTORCRAFT YT-1011
SUPPORT AND CLAMP ASSEMBLY TOOL T81P-19623-D
3630-015-28

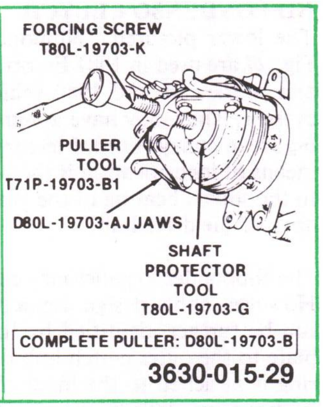

FORCING SCREW T80L-19703-K
PULLER TOOL T71P-19703-B1
D80L-19703-AJ JAWS
SHAFT PROTECTOR TOOL T80L-19703-G
COMPLETE PULLER: D80L-19703-B
3630-015-29

Fig. 28—Hub Removal Fig. 29—Pulley and Bearing Removal

4. Thread tool T80L-19703-B or YT-1011 into the clutch hub and tighten the inner bolt to pull the hub from the shaft, Fig. 28. Remove the shims.
5. Remove the pulley retaining snap ring.
6. If the pulley and bearing assembly cannot be removed by hand, use Shaft Protector T80L-19073-G for a base and three jaw puller D80L-19073-B to pull the pulley and bearing assembly from the compressor as shown in Fig. 29.

NOTE:
Tool D80L-19073-B is made-up of the following component pieces:

• Pulley Puller Spider	T71P-19703-B
• Pulley Puller Jaws (3)	D80L-19703-AJ
• Center Bolt	T80L-19703-K

Clutch Field Coil Servicing

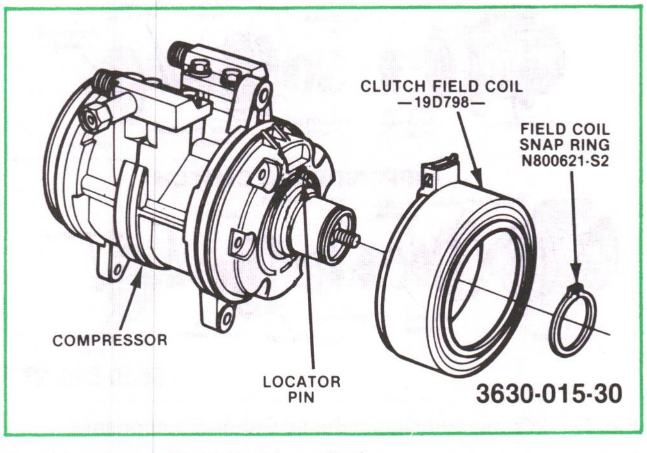


Fig. 30—Clutch Field Coil Installation

Removing the Clutch Field Coil

1. Remove the clutch hub and pulley assembly
2. Remove the snap ring retaining the clutch field coil on the head of the compressor.
3. Pull the field coil from the front of the compressor.

Installing the Clutch Field Coil

1. Position the clutch field coil to the compressor, engaging the locator pin on the compressor head with the hole in the clutch field coil.
2. Install the snap ring to retain the clutch field coil on the compressor with the bevel side of the snap ring out, Fig. 30.
3. Install the pulley and hub assembly on the compressor.

Clutch and Pulley Installation

NOTE:
Before installing the clutch assembly, a shaft seal leak test should be made—especially if an accumulation of oil was noticed on the compressor shaft and clutch during disassembly.

1. The hub key is slightly crooked and must be installed so that it wedges itself tightly in the compressor shaft keyway, Fig. 31.
2. Clean the compressor head and install the pulley and bearing assembly as illustrated in Fig. 32.
3. Install the pulley snap ring, beveled side out.
4. Shims of varying thickness are available as a pack. When installing the hub, select and install the two thickest shims available against the shoulder of the compressor shaft to control air gap. Align the shaft key with the keyway in the hub as shown in Fig. 31, and install the hub on the shaft using the tool shown in Fig. 33, if necessary. **Do not drive the hub onto the shaft as damage to the compressor will result.**
5. Install the hub retaining nut and tighten the nut to 10-14 ft.-lbs. (13-19 N·m)
6. With the clutch de-energized, check the air gap between the hub and the mating pulley surfaces in three locations equally spaced around the pulley, Fig. 34. Rotate the compressor shaft or pulley one-half turn (180 degrees) and again check the air gap in three equally spaced locations. The average air gap must be within the specified limits (0.021″-0.036″). The desired dimension is .029″.
7. Add, remove or substitute shims as necessary until the air gap is within specifications.

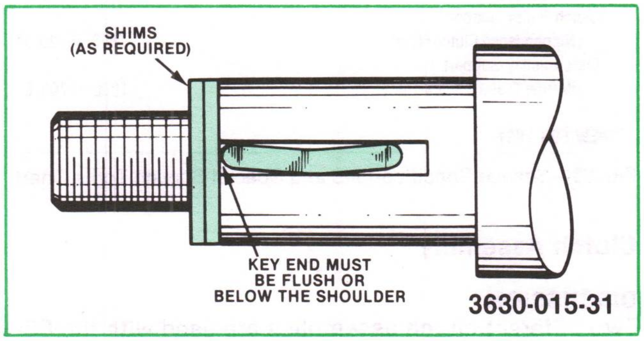


Fig. 31—Hub Key and Shim Installation

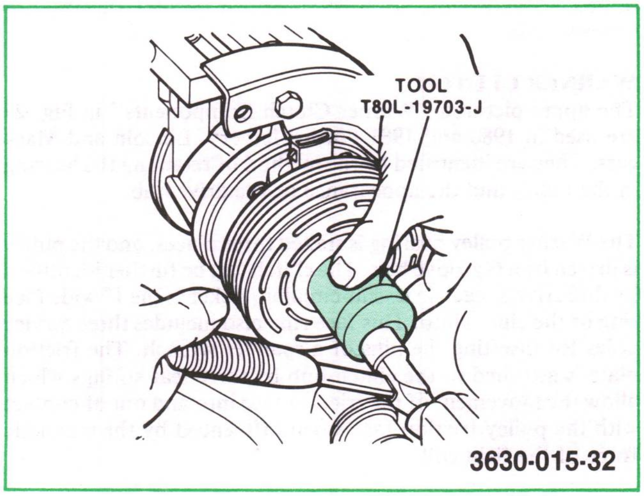


Fig. 32—Pulley Installation

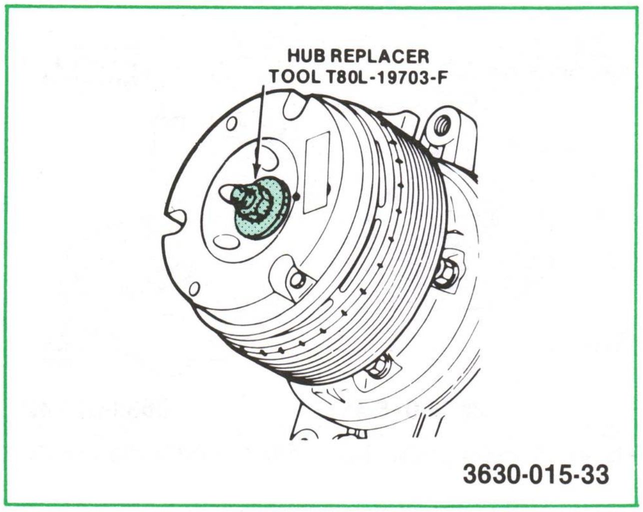


Fig. 33—Hub Installation

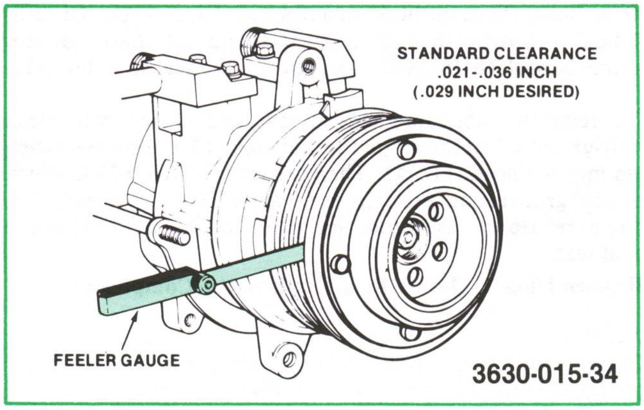


Fig. 34—Checking Clutch Air Gap

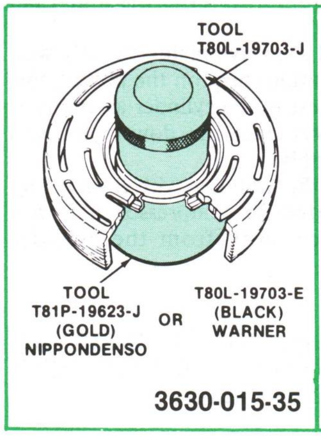


Fig. 35—Removing Pulley Bearing

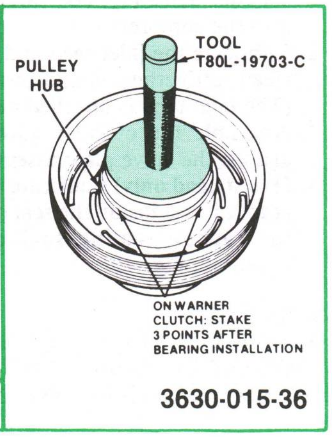


Fig. 36—Installing Pulley Bearing

Bearing Removal

The bearing is removed from the pulley in the same manner for both the Warner and Nippondenso clutches, except as noted:

- The single bearing used with the Warner clutch is staked in place and can be removed without any preparation using the tools shown in Fig. 35.
- The bearing(s) used with the Nippondenso clutch are held in place with a wire retainer ring which must be removed first. Then the bearing(s) can be pressed out with the tools shown in Fig. 35.

Bearing Installation

For the single-bearing Warner clutch:

1. Place clutch pulley face down on the small opening of tool T80L-19703-E or equivalent.
2. Insert the dust shield in the bearing bore so as to extend into the opening in tool T80L-19703-E or equivalent.
3. Align the bearing with the bearing bore and press or drive it into the bore until it is seated, using tool T80L-19703-C or equivalent, Fig. 36.
4. Stake the bearing in three equally spaced places. Do not use the same locations used to retain the removed bearing.

For the one- or two-bearing Nippondenso clutch:

1. Place clutch pulley face down on the small opening of tool T81P-19623-J or equivalent.
2. Insert the dust shield in the bearing bore. Center the pulley on the tool to prevent warping the pulley friction surface.
3. Align the single or first bearing with the bearing bore, open bearings up, and press or drive it into the bore until it is seated, using tool T80L-19703-C or equivalent.
4. Align the second new bearing (if two are used) with the open bearings down. Press or drive it into the bore until it seats against the first bearing, using tool T80L-19703-C or equivalent, Fig. 36.
5. Install the wire retainer ring to hold the bearing(s) in place.

Servicing the Compressor Front/Rear Heads

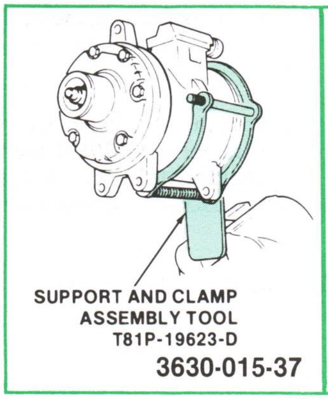


Fig. 37—Retain Rear Head to Service Front Head

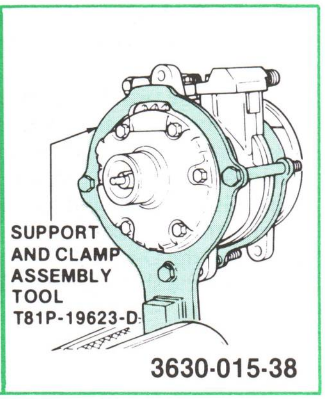


Fig. 38—Retain Front Head to Service Rear Head

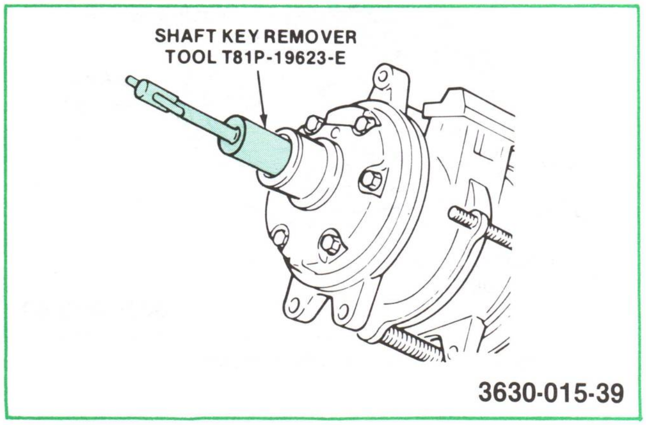


Fig. 39—Removing Shaft Key

1. To service either head of the compressor, mount the unit in the support and clamp assembly tool, Fig. 37 or Fig. 38, **before** loosening the 6 through bolts. This will retain seal integrity for the head not being serviced, and the center joint.
2. The compressor shaft key must be removed before the front head can be removed from the cylinder assembly. Slip the shaft key remover tool over the key, Fig. 39, and rotate one-half turn in either direction to engage the key. Tighten the T-handle screw to draw the key from the shaft.

With the clutch assembly and shaft key removed, the front head of the compressor may be removed to service the inlet reed, front valve plate assembly, cylinder gasket, shaft seal assembly, seal seat assembly, O-ring, front head assembly and felt seal.

Removal of the rear head allows inspection and servicing of the O-ring, inlet reed, rear valve plate assembly, cylinder gasket and rear head.

Disassembly— Both Heads

Disassembly—Both Heads

IMPORTANT:
Whenever the front head is removed, the seal seat assembly, shaft seal assembly, O-ring cylinder head gasket and 6-brass washers must be replaced.

1. Remove the 6-8 MM through bolts and separate the front head from the cylinder assembly. Tap around the edge lightly with a fiber hammer or equivalent to break the head loose, if necessary. NOTE: Use extreme care not to damage any sealing surfaces.
2. Remove the two dowel pins.
3. Carefully lift the inlet reed plate from the head assembly.
4. Remove the valve plate assembly with tool T81P-19623-B or equivalent, Fig. 40. Engage the shoulder of the tool under the valve plate and tighten the T-handle screw to separate the plate from the head.
5. Remove the O-ring
6. Remove the shaft seal and felt seal. (Front head only)

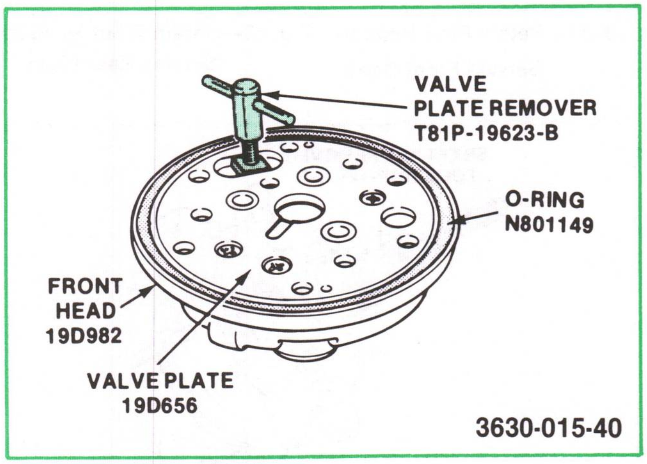


Fig. 40—Removing Valve Plate from Head

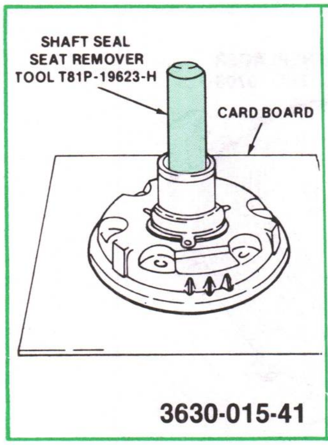


Fig. 41—Removing Seal Seat

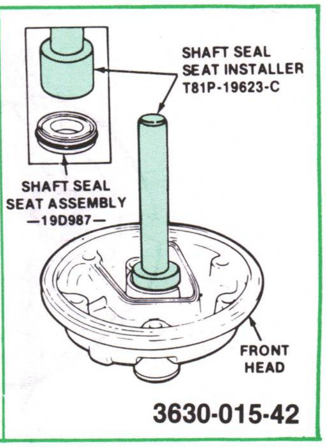


Fig. 42—Installing Seal Seat

Removing and Installing the Shaft Seal Seat

The front seal seat must be removed toward the inside of the front head. Place the head on a piece of **clean** corrugated cardboard to protect the sealing surface and use shaft seal seat remover tool T81P-19623-H to remove the seal seat, Fig. 41.

To reinstall, lubricate the seal seat and O-ring with clean refrigerant oil and position the seal seat **with the groove facing up** into the head, Fig. 42. Then use tool T81P-19623-C which fits the groove, and insert the seal seat until it "bottoms-out" in the bore. **Do not** use a tool that pilots in the shaft hole of the seal seat.

Reassembling the Front/Rear Heads to the Compressor

NOTE:
Steps 4, 8, and 9 apply to the **front head only,** as indicated. All other steps apply to **both** the front and the rear head.

1. Insert the two dowel pins into the dowel pin openings in the cylinder assembly. (Be careful not to drop the dowel pin into the compressor.)
2. Lubricate the inlet reed and the valve plate assembly with clean refrigerant oil and position them on the dowel pins. (The inlet reed is installed next to the cylinder assembly.)
3. Assemble the cylinder gasket over the dowel pins and against the valve plate assembly.
4. **(Front head only)** Lubricate the shaft seal with clean refrigerant oil and install the seal over the compressor shaft with the carbon sealing surface away from the cylinder assembly, Fig. 43.

IMPORTANT:
INTERNAL FLATS OF THE SEAL MUST ENGAGE TWO FLATS ON THE SHAFT, AND THE CARBON SEAL MUST ENGAGE THE RETAINING RING TABS.

NOTE:
Avoid handling the carbon sealing surface of the shaft seal assembly to prevent damage to the surface.

5. Lubricate and install a new O-ring in the groove of the head sealing surface.
6. Assemble the head to the compressor by aligning the holes in the head with the dowel pins in the cylinder assembly.
7. Use new brass flat washers and install the 6-8 MM through bolts snugly. Then torque the bolts diagonally 18-19 Ft.-Lbs. (24.5—26.5 N·m).

NOTE:
Some compressors may be encountered which do NOT have brass washers. Always install new brass washers when re-assembling FS-6 compressors even if they were not present during disassembly.

8. **(Front head only)** Insert a new felt seal in the shaft bore of the head, and insert the key in the slot of the compressor shaft as previously described.
9. **(Front head only)** Assemble the coil, pulley, and clutch assembly to the compressor head as previously described.
10. Fill with clean refrigerant oil equal to the amount removed prior to disassembly, but not over 6 ounces, maximum.

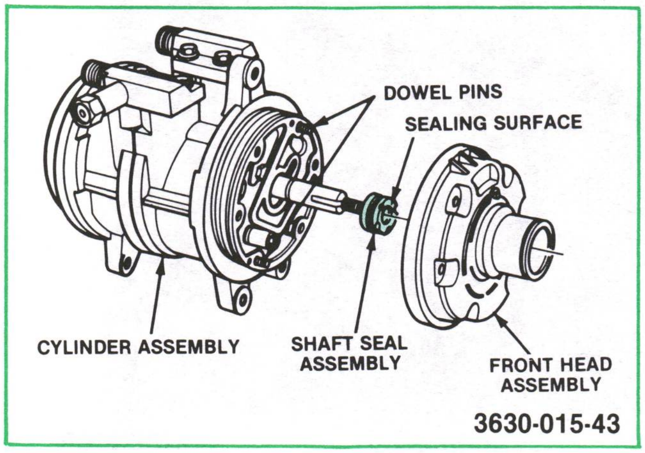


Fig. 43—Installing the Shaft Seal Assembly

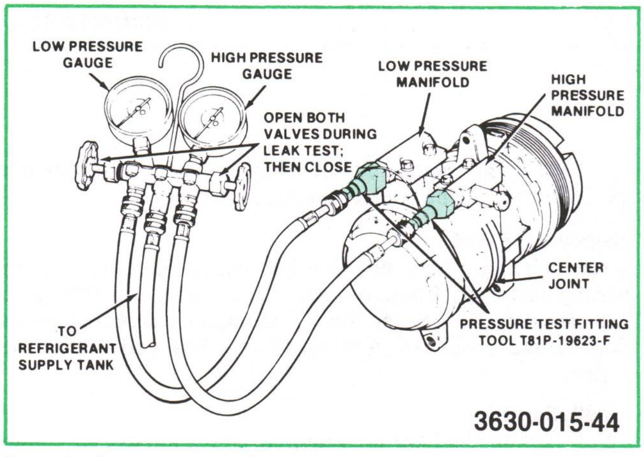

LOW PRESSURE GAUGE
HIGH PRESSURE GAUGE
LOW PRESSURE MANIFOLD
HIGH PRESSURE MANIFOLD
OPEN BOTH VALVES DURING LEAK TEST; THEN CLOSE
CENTER JOINT
TO REFRIGERANT SUPPLY TANK
PRESSURE TEST FITTING TOOL T81P-19623-F
3630-015-44

Fig. 44—External Leak Test Hook-Up

Conducting External Leak/Rotating Torque Checks

Prior to conducting a leak test, torque the four manifold bolts to 13-17 Ft.-lbs. (18-23 N·m) NOTE: If the manifold attaching bolts were loose, remove them one at a time, apply loctite sealant and retorque the bolts 13-17 Ft.-lbs. (18-23 N·m). Remove the Schrader type valves from the test fitting tools, if so equipped, and attach pressure test fitting tool T81P-19623-F. Connect the high and low pressure lines of a manifold gauge set to the corresponding fittings of the pressure test tool. The center hose of the manifold gauge set must be attached to a refrigerant drum standing in an upright position. Proceeed with the test as follows:

1. Open the low pressure gauge valve, the high pressure gauge valve, and the valve on the refrigerant drum to allow the refrigerant vapor to flow into the compressor.

2. Using a leak detector, check for leaks at the compressor rear head seal, compressor front head seal, the compressor shaft seal and the suction and discharge manifolds mounted to the compressor. After checking, turn OFF the manifold gauge valves.

If an external leak is found at either head, either manifold or at the shaft seal, repair as necessary. If an external leak is found at the center joint of the compressor body, install a new compressor assembly.

Compressor Rotating Torque Check

The rotational torque of a compressor should be checked if excessive compressor drag is suspected.

1. Discharge the refrigerant system following the recommended service procedures. Observe all safety precautions.
2. Rotate the compressor shaft and note the torque required for one complete rotation. Observe the torque while rotating the compressor shaft, not the starting torque.
3. If the rotational torque exceeds 7 ft.-lb. (10 N·m), replace the compressor assembly.
4. If the rotational torque is less than the specified rotational torque, excessive drag does not exist in the compressor and no corrective action is indicated.

DEALER INSTALLED AIR CONDITIONING

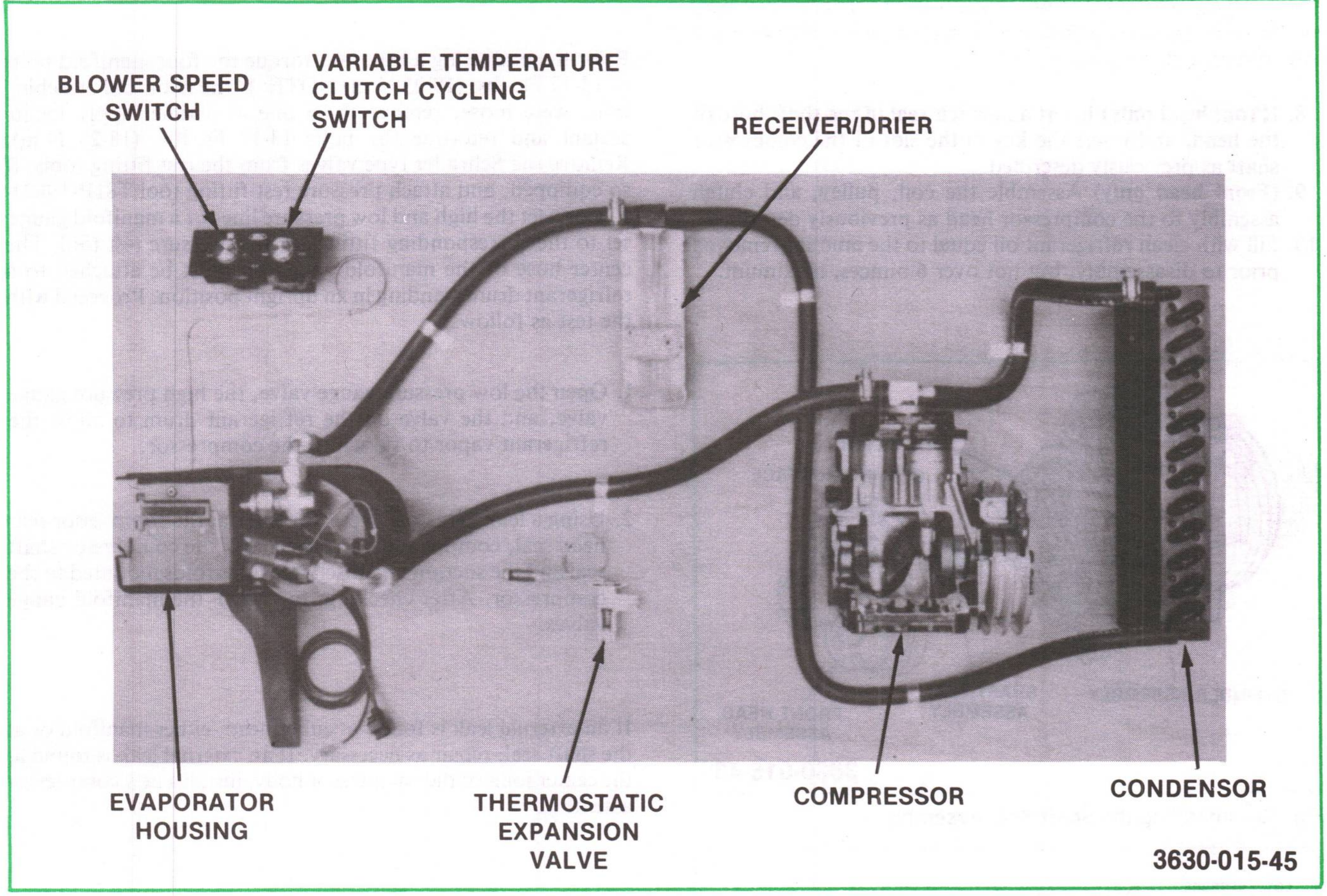


Fig. 45—Dealer Installed Air Conditioning (Typical)

Introduction

A basic, dealer-installed air conditioning system consists of the components shown in Fig. 45 and may also contain, depending upon the installation:

- A four-position blower speed control switch
- Blower motor and air ducts
- RPO bezel and controls

Features that readily distinguish a dealer-installed system from a factory installed air conditioner include:

- Push-on hose connectors
- Receiver/drier mounted near the condenser
- York 2-cylinder compressor
- Thermostatic expansion valve (TXV)
- De-Icing switch

System Types

Two distinctive types of dealer-installed air conditioning kits are used on Ford vehicles:

Integrated A/C

The integrated air conditioning kit makes use of components that are already part of the vehicle's heating system:

- Blower Motor
- Heater Case and Plenum Chamber
- Blend Air Door
- Floor Defrost Door
- Panel Door
- Outside Air Door

Like factory-installed air conditioning, the integrated system is capable of supplying cooled outside air to the car.

Recirculating A/C

A recirculating air conditioning installation does not use any existing heat distributing components, but must function alone as a closed system. It operates in the manner described by its name: cooling and recirculating air that is already inside the vehicle.

Installation Kits

Up to six individual kits are required for a complete air conditioning installation:

- Evaporator Kit
- Condenser Kit
- Bezel and Controls Kit
- Compressor and Clutch Kit
- Engine Drive Kit
- Carburetor Fast Idle Kit

These kits will be discussed in detail later on.

There may also be specific requirements for other components not contained in any kit:

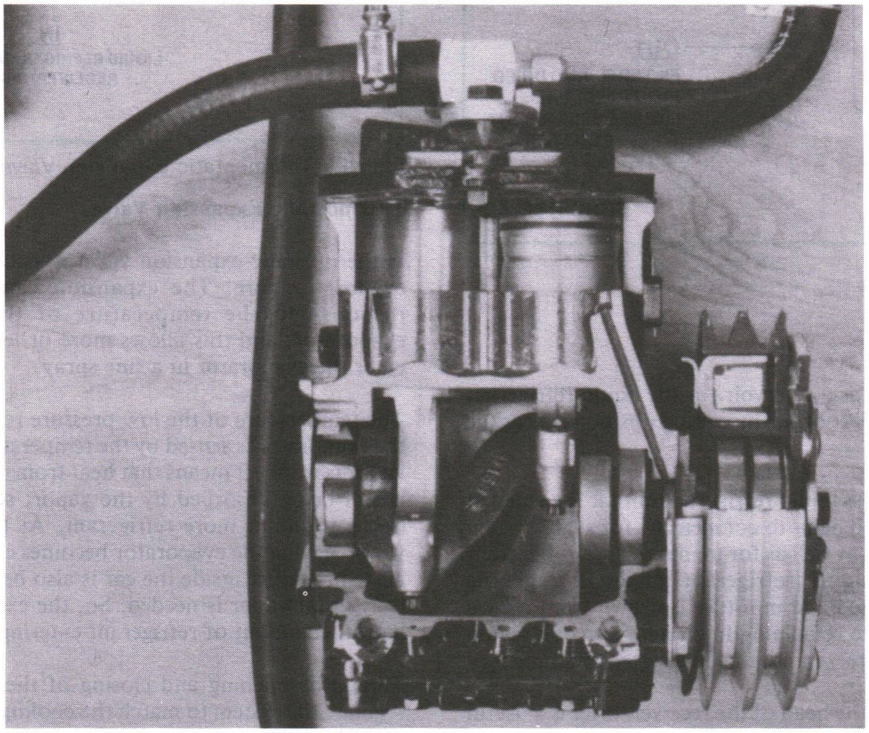
- Extra Cooling Components
- Auxiliary Clutch Cut-Off Controls.

Check the current Model Application Chart for kit part number and extra cooling requirements.

Basic System Operation

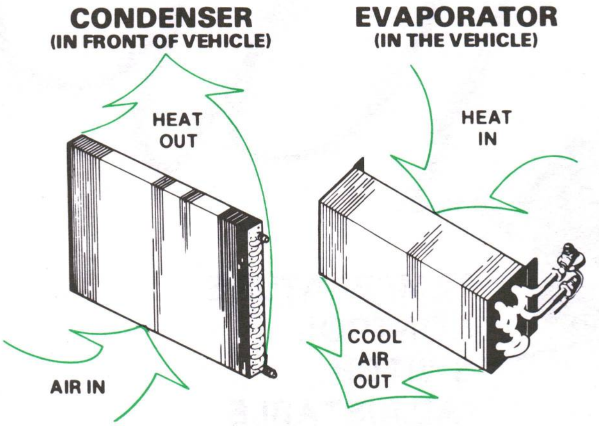
Compressor

The compressor is the pump that circulates refrigerant through the air conditioning system. But it also does something even more important to the overall process that makes cooling the car possible. It compresses low pressure refrigerant vapor, drawn from the evaporator, into a dense high-pressure vapor. The heat of compression raises the vapor's temperature above that of the surrounding air. Then, when the hot, dense vapor reaches the condenser, the cooler outside air passing through the condenser's fins and over its coils, cools the hot, high pressure vapor so that it condenses back into liquid form. Without the condensation of the refrigerant to a liquid, there could be no expansion back to a vapor in the evaporator, and it is the expansion and vaporization of the refrigerant which cools the air passing through the evaporator and into the vehicle. The cooler, low pressure vapor is drawn back to the compressor where the cycle begins again.



3630-015-46

Fig. 46—York Compressor Used In Dealer Installation



3630-015-47

Fig. 47—Condenser and Evaporator (Typical)

Condenser and Evaporator

The condenser is mounted in the cool air stream in front of the radiator where it can receive a large volume of cool air. The flow of air through the condenser fins, cools the hot, high pressure vapor from the compressor and causes it to condense to a high pressure liquid.

High pressure liquid refrigerant enters the evaporator mounted inside the vehicle as a spray, and lower pressure in the evaporator causes the spray to quickly vaporize (become a gas). As it does, it absorbs a large quantity of heat from the air surrounding, or passing through, the evaporator fins to cool the interior of the vehicle.

The condenser and evaporator provided in a dealer installation are somewhat smaller in size than factory installed equipment. As a result, cooling effectiveness may be somewhat lower at high outside temperatures.

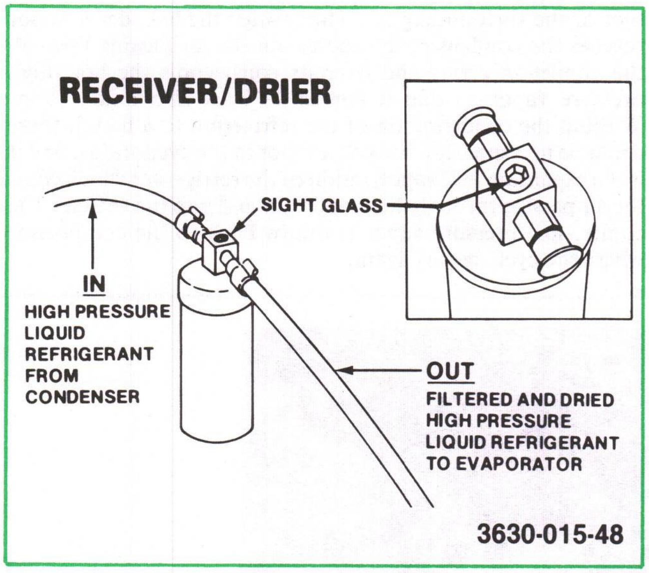

RECEIVER/DRIER
SIGHT GLASS
IN
HIGH PRESSURE LIQUID REFRIGERANT FROM CONDENSER
OUT
FILTERED AND DRIED HIGH PRESSURE LIQUID REFRIGERANT TO EVAPORATOR
3630-015-48

Fig. 48—Receiver/Drier

Receiver/Drier

The receiver/drier acts as a reservoir for the liquid refrigerant leaving the condenser. Its normal mounting position is near the radiator.

The receiver stores excess liquid refrigerant until it is needed at the expansion valve, and helps to compensate for slight system over or under charging, as well as for modest loss of refrigerant through leakage. As liquid refrigerant passes through the receiver/drier it is filtered and moisture is drawn from it by a desiccant. Any moisture remaining in circulation could cause the expansion valve to freeze, resulting in a system malfunction.

A sight glass located in the head of the receiver/drier is a useful diagnostic aid, and will be discussed later.

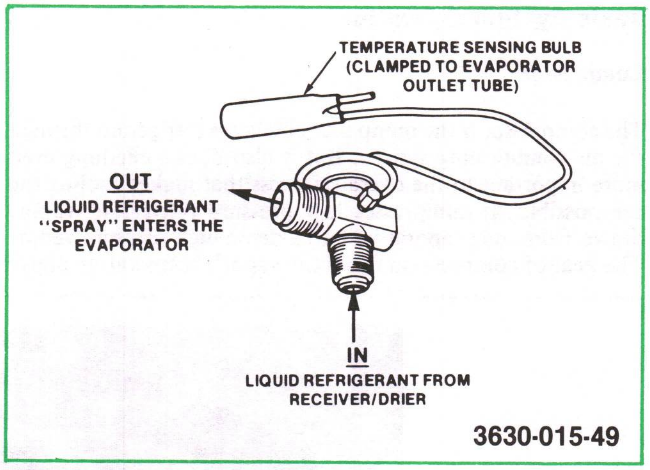

TEMPERATURE SENSING BULB (CLAMPED TO EVAPORATOR OUTLET TUBE)
OUT
LIQUID REFRIGERANT "SPRAY" ENTERS THE EVAPORATOR
IN
LIQUID REFRIGERANT FROM RECEIVER/DRIER
3630-015-49

Fig. 49—Thermostatic Expansion Valve (TXV)

Thermostatic Expansion Valve

A thermostatic expansion valve is installed at the inlet to the evaporator core. The expansion valve opens or closes in response to the temperature of the vapor leaving the evaporator, and this allows more or less liquid refrigerant to enter the evaporator in a fine spray.

The temperature of the low-pressure refrigerant vapor leaving the evaporator is sensed by the temperature sensing bulb. If the vapor is warm, it means that heat from the air inside the vehicle is still being absorbed by the vapor; so, the expansion valve opens to admit more refrigerant. As the temperature of the vapor leaving the evaporator becomes cooler, it means that the air temperature inside the car is also becoming cooler and less refrigerant vapor is needed. So, the expansion valve closes to limit the amount of refrigerant entering the evaporator.

Thus, this opening and closing of the expansion valve helps regulate the system to match the cooling needs of the air within the vehicle.

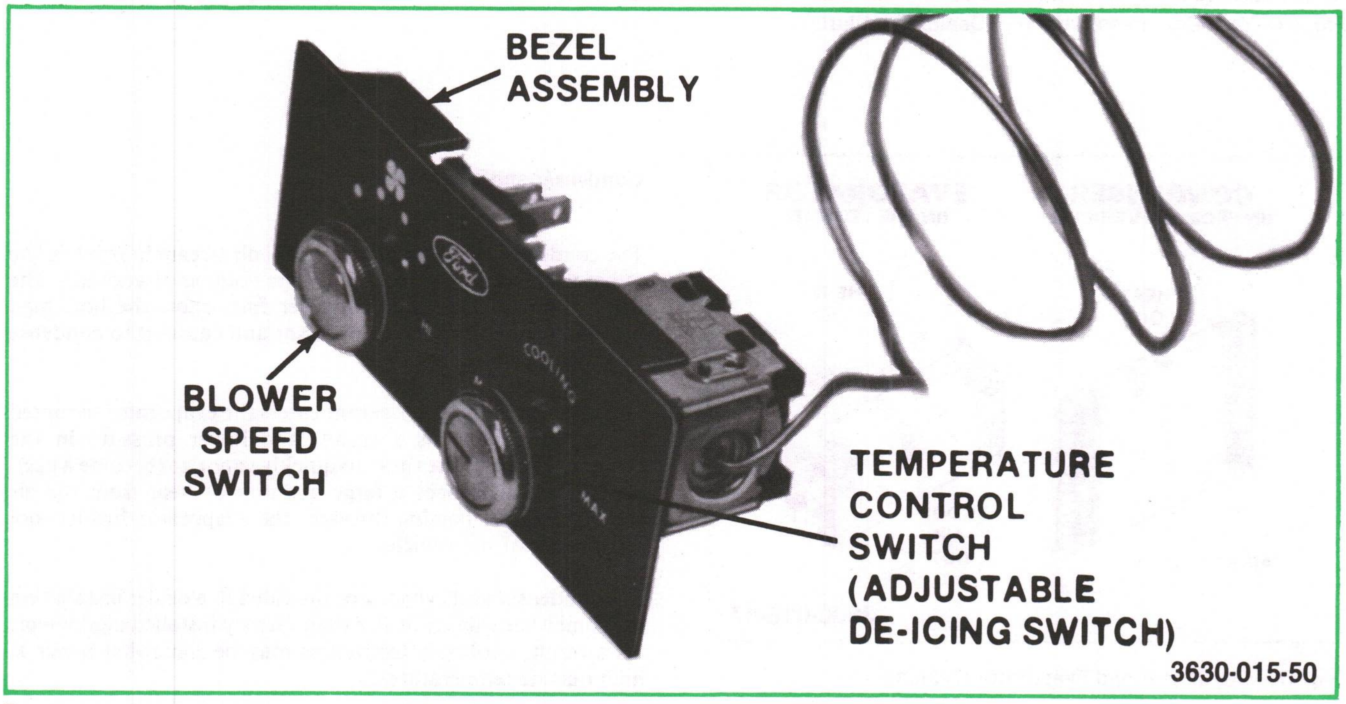


Fig. 50—System Controls for Recirculating A/C (Typical)

System Controls

Recirculating A/C

Manual air conditioning controls supplied with dealer-installed recirculating systems include a 4-position blower switch (“OFF” plus 3 blower speed settings), and a variable temperature clutch cycling switch (also known as an adjustable de-icing switch).

The variable temperature clutch cycling switch and capillary tube assembly in Fig. 51 “reads” the evaporator temperature in relation to the control-knob “comfort” setting selected by the driver, and cycles the compressor clutch on and off accordingly. The cooler the temperature chosen by the driver, the longer the compressor runs—delivering more liquid refrigerant to the evaporator through the thermostatic expansion valve. With the control knob set for less cooling, the contact points in the clutch cycling switch open sooner—stopping clutch operation and reducing the supply and pressure of liquid refrigerant to the expansion valve.

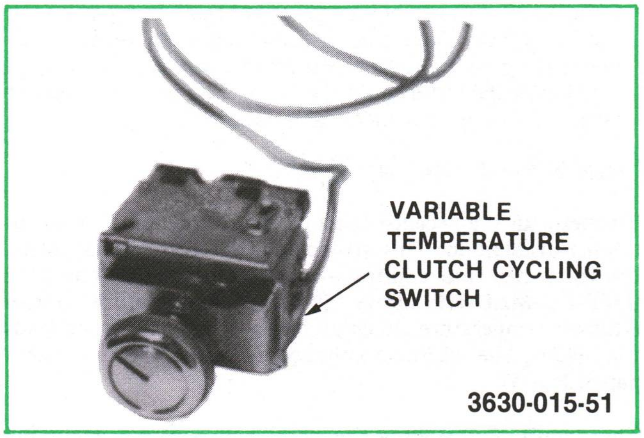


Fig. 51—Evaporator Temperature Control Switch

Integrated A/C

With integrated dealer-installed air conditioning systems, temperature control is by the blend-air door supplied with the existing heater. Blower speed is also regulated using existing heater controls.

A non-adjustable de-icing switch is mounted on the evaporator housing in the engine compartment, Fig. 52, and cycles the compressor clutch off at a pre-set evaporator core temperature to prevent the formation of ice on the evaporator fins. This switch helps “even-out” the temperature range of the evaporator for maximum operating efficiency.

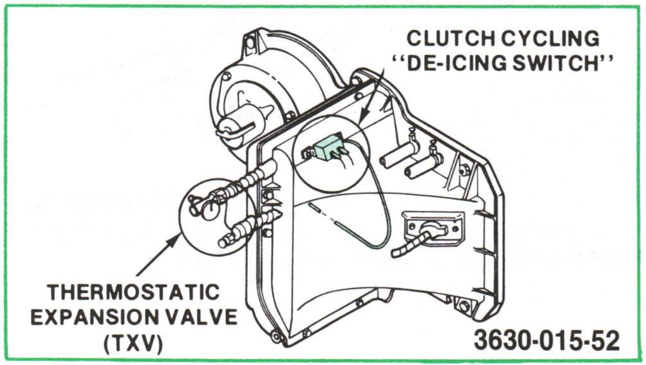
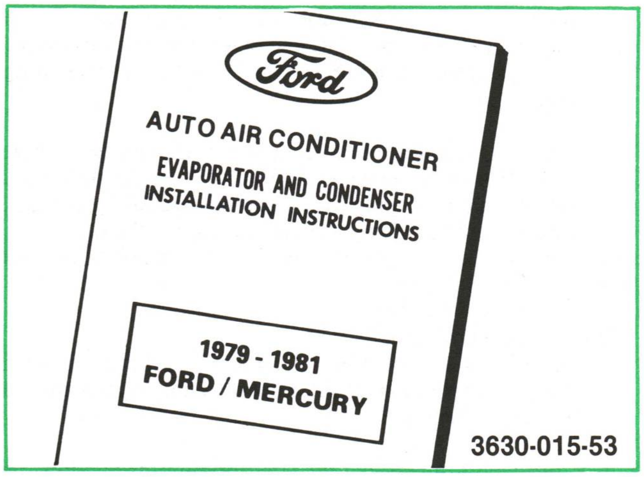

CLUTCH CYCLING “DE-ICING SWITCH”
THERMOSTATIC EXPANSION VALVE (TXV)
3630-015-52

Fig. 52—Non-Adjustable Refrigerant System Controls



Ford

AUTO AIR CONDITIONER

EVAPORATOR AND CONDENSER
INSTALLATION INSTRUCTIONS

1979 - 1981
FORD / MERCURY

Fig. 53—Installation Instructions

Installation Kits

Using the Instructions Brochures

Each of the various kits required for a complete dealer-installed air conditioning system comes with a detailed installation instructions brochure keyed to the car models for which the kit was designed and released.

To ensure a quality installation, read the instructions brochure thoroughly **before** beginning, and pay particular attention to any **“CAUTION”** notes. Then, carefully complete each step of the installation procedure in its proper sequence.

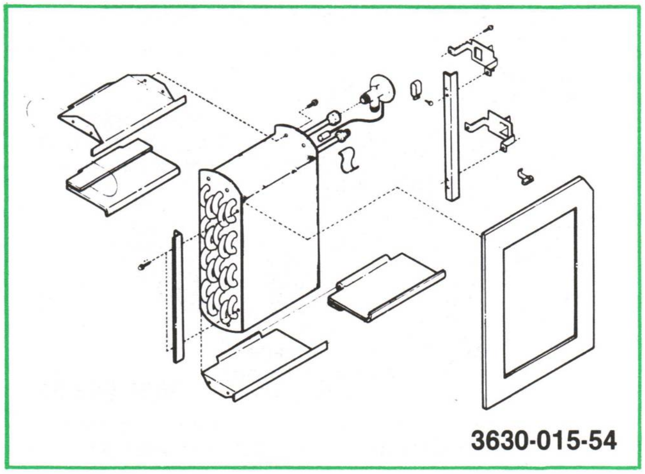


Fig. 54—Evaporator Kit for Integrated A/C (Typical)

Evaporator Kit—Integrated A/C

Integrated air conditioning uses evaporator core and components mounted within the existing heater housing, Fig. 54

Only a few minor modifications to the housing are necessary to complete the installation, as detailed in the evaporator kit instructions brochure.

Changes to the heater control head include replacing the panel and lens assembly with one that has air conditioning call-outs, and installing a 9-port A/C vacuum switch.

The integrated A/C system also uses a compressor kit, an engine drive kit, a condenser kit, and in most cases a carburetor fast idle kit essentially the same as those used for recirculating A/C installations.

The integrated air conditioning installation, with its A/C 9-port vacuum control valve, achieves most of the benefits of factory air. It is capable of supplying cooled outside air to the car, temperature regulation is by a cable-controlled "blend" door, and air distribution is controlled by vacuum motors. Integrated systems are available for:

1979-81 Ford and Mercury Cars
1980-81 T-Bird and XR-7
1979-80 Ford F-Series Light Trucks and Broncos with Comfort-Vent Heater Option. (Not available with Standard or Hi-Output heaters).

For a top-quality integrated air conditioning installation, be sure to:

- Read and understand the instructions completely
- Follow all instructions carefully
- Install all seals carefully
- Use refrigerant oil as a lubricant on fittings
- Route hoses neatly, away from hot objects and sharp edges
- Check to make sure hoses:
  - —Do not interfere with any serviceability, maintenance, or inspection items
  - —Do not interfere with the operation of engine linkage and controls
- Make sure the capillary tube of the de-icing switch makes firm contact with the fins of the evaporator.
- Make sure the sensing bulb of the thermostatic expansion valve makes firm, clean contact with the evaporator outlet tube, and is properly wrapped with insulating tape.

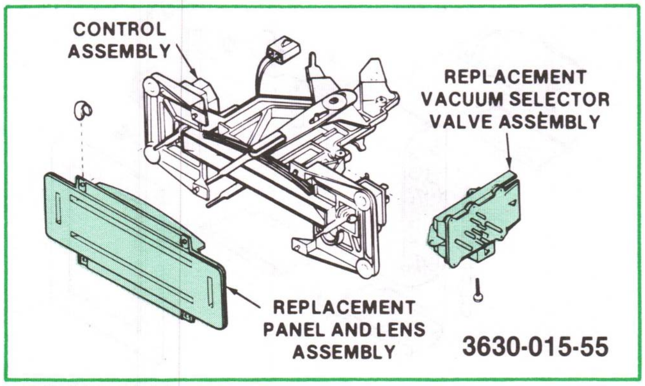

CONTROL ASSEMBLY
REPLACEMENT VACUUM SELECTOR VALVE ASSEMBLY
REPLACEMENT PANEL AND LENS ASSEMBLY
3630-015-55

Fig. 55—Ford/Mercury Control Head for Integrated A/C

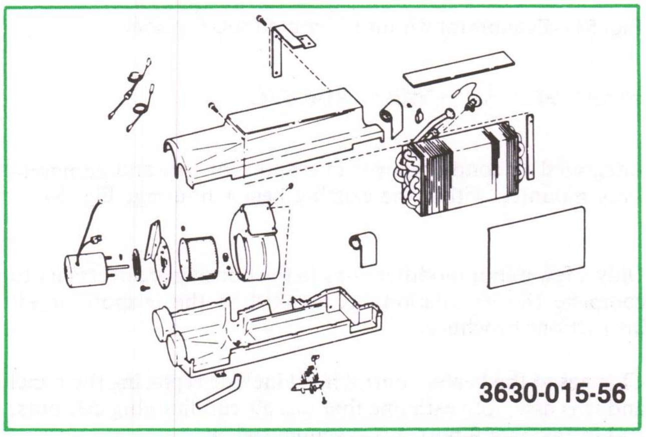


Fig. 56—Evaporator Kit for Recirculating A/C (Typical)

Evaporator Kit—Recirculating A/C

The evaporator kit for a dealer-installed recirculating air conditioning system consists of a self-contained module that houses the evaporator, thermostatic expansion valve (TXV), blower, and blower motor, Fig. 56. It is mounted inside the passenger compartment, but shares none of the vehicle's heating system components. Thus, the recirculating A/C installation also requires a separate air distribution system (bezel kit) to perform its task of cooling and recirculating air that is already inside the vehicle. There are no provisions for fresh air intake.

Because of its mounting location within the passenger compartment, special precautions must be taken during evaporator kit installation:

- Make sure the opposite side of the dash panel or floor panel is clear of obstructions BEFORE drilling holes for the refrigeration and evaporator-drain hoses
- Make sure the condensate tube is correctly installed and not pinched or obstructed
- Completely wrap exposed metal refrigeration parts with insulation tape. These parts become cold when the air conditioner is operating, and any moisture condensing on them could eventually drip onto the floor. The use of insulation tape will prevent this undesirable condition.

Bezel Kit—Recirculating A/C

The bezel kit is a necessary part of any recirculating air conditioning installation. This kit includes the air registers, ducts, control panel, and controls—which consist of a 4-position (OFF-LO-MED-HI) blower switch, a temperature control (variable temperature clutch cycling switch), and wiring leads for making the electrical connections under the instrument panel, Fig. 57.

The details of installing the bezel and controls, including wiring, are covered in the evaporator and condenser installation instructions brochure.

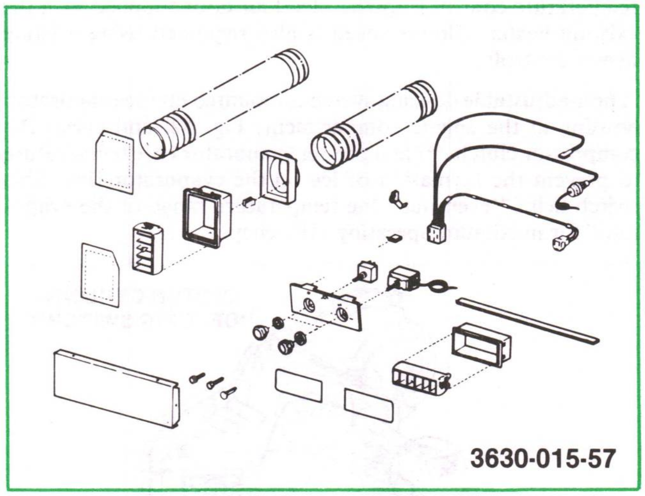


Fig. 57—Bezel Kit for Recirculating A/C (Typical)

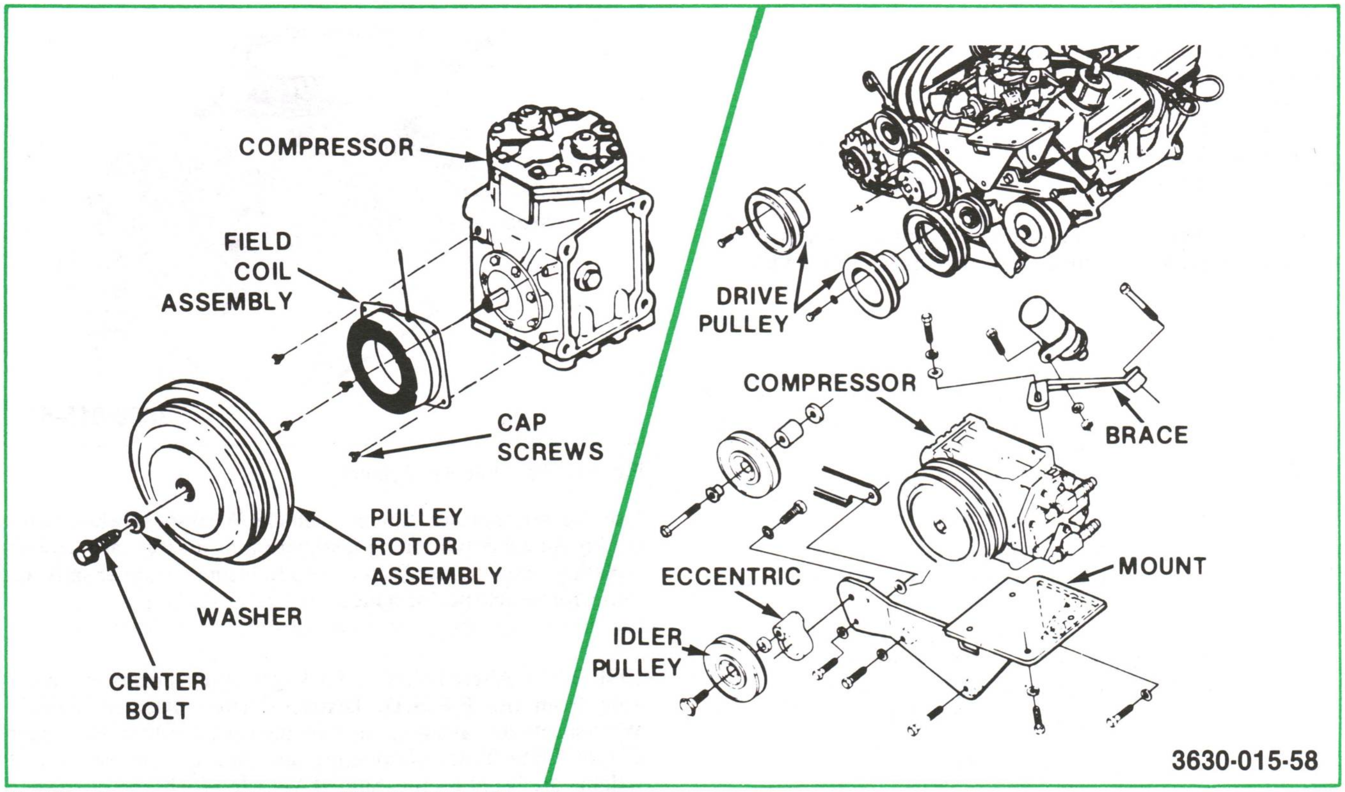


Fig. 58—Compressor, Clutch and Engine Drive Kits (Typical)

Compressor & Clutch Kit / Engine Drive Kit

The compressor and clutch kit for a dealer-installed air conditioning system includes:

- Two-cylinder, York compressor—ideal for custom installations because of its mounting-angle flexibility
- Compressor clutch
- Pulley
- Attaching parts

The engine drive kit includes everything necessary for mounting the compressor to the engine, as well as pulleys and belts required to drive the compressor:

- Compressor mount
- Pulleys
- Belts (if required)
- Fan spacer (if needed)
- Attaching hardware
- Replacement mounting brackets for repositioning other engine mounted components, as required.

Detailed step-by-step procedures and a bill of materials are given in the installation instruction brochure for each kit. The latest Model Application Chart must be checked for possible extra cooling equipment that must be installed for satisfactory operation.

A top-quality compressor/engine drive kit installation requires:

- Following all instructions completely
- Tightening all bolts and nuts to the rated torque capacity for their size, or as otherwise instructed
- Adjusting drive belts to the proper tension as specified in the Shop Manual
- Check all engine compartment vacuum hoses and electrical wiring that might have been disturbed or rerouted during kit installation to be sure that the hoses are not kinked, that they do not touch any high temperature item such as EGR valve, manifold, carburetor spacer, etc., and that they do not interfere with any linkage components.

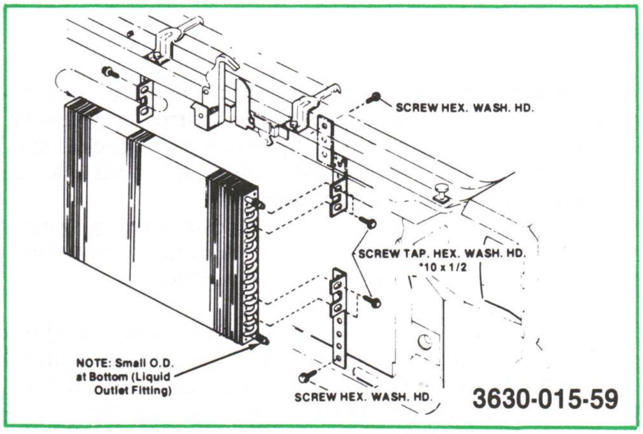

SCREW HEX. WASH. HD.
SCREW TAP. HEX. WASH. HD. #10 x 1/2
NOTE: Small O.D. at Bottom (Liquid Outlet Fitting)
SCREW HEX. WASH. HD.
3630-015-59

Fig. 59—Condenser Installation (Typical)

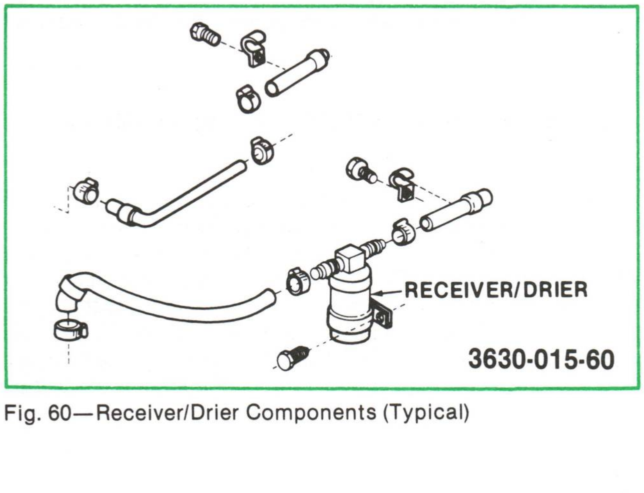


Fig. 60—Receiver/Drier Components (Typical)

Condenser Kit

A typical condenser kit includes:
- Condenser assembly
- Receiver/drier unit
- Mounting brackets
- Hoses and clamps
- Attachment hardware

Installation details for the condenser and receiver/drier are given in the installation instructions included with the kit.

A quality installation of the condenser kit requires attention to the following:
- Read and follow all instructions fully.
- Mount the condenser directly in front of and parallel to the radiator core, with a clearance of 1/2″ to 1″ to the radiator core and a clearance of 1/4″ to all other components and metal surfaces.
- Attach receiver/drier using clamp supplied and #14 × 3/4″ hex washer head screw.
- Cut hoses to length. **Keep ends square.**
- Lubricate condenser fittings with a few drops of refrigeration oil
- Slide hose clamps over end of hose. Force hoses onto fittings with rotating motion. CAUTION: Do not go past the shoulder and do not scratch fittings with tools.
- Position clamps with spacer over end of hose to obtain the optimum clamp location.
- Torque hose clamps to 37-43 in.-lbs.
- Route hoses neatly; away from hot objects and sharp edges.
- Make sure hoses do not interfere with serviceability, maintenance or inspection items.
- Make sure hoses do not interfere with operation of engine linkage and controls.

Carburetor Fast Idle Kit

The carburetor fast idle kit is used to compensate for the compressor load and other emissions related controls as necessary. The typical kit includes a throttle positioner (either electric or vacuum operated). The following additional items may be included in various kits, as required:
- wiring harness
- vacuum hose and connections
- hot idle compensator valve
- power steering switch
- A/C time delay relay
- isolation relay

The fast idle kit shown in Fig. 61 (for a 1981 light truck) is a good example of some of the variations that will be encountered from one kit to the next. The throttle positioner (item #1) is factory-installed on the engine, in this instance, but is nonfunctional. Installation instructions that come with the fast idle kit provide hook-up information. The hot idle compensator valve (item #2), however, is a kit component, and must be installed per the instructions.

Federal Regulations Regarding Fast Idle Kit Installation

IMPORTANT:
To assure compliance with emission regulations and customer satisfaction with vehicle performance, it is mandatory that when air conditioning is installed on any car or truck, that the Carburetor Fast Idle Kit specified in the program announcement materials and dealer installation instructions be installed. Failure to maintain the emissions controls systems as specified by Ford Motor Company may result in penalties as outlined in the applicable emission laws.

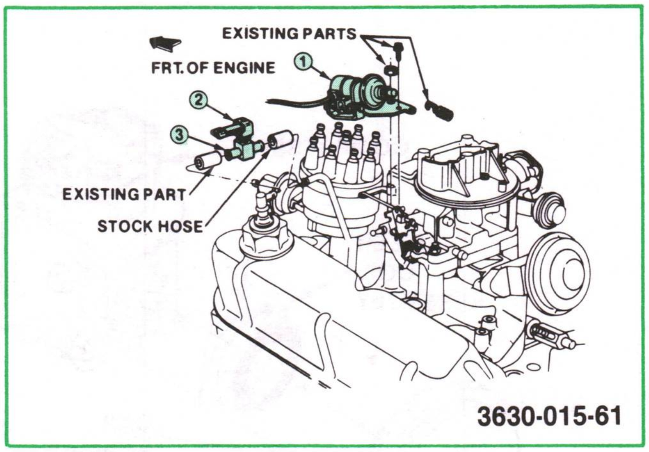


Fig. 61—Fast Idle Kit (Typical)

Use the appropriate Altered Vehicle Worksheet when completing an air conditioning installation as a safeguard against violating emission regulations, and to insure customer satisfaction with vehicle performance. NOTE: For your protection the completed worksheet should be retained for at least 5 years.

1981 Dealer Altered Vehicle Packages Order Forms are available from the F.P.S.D. District Office. Altered Vehicle Worksheets are available in two packages: Either Passenger Car or Light Truck, Econoline and Bronco. Accessory add weights are listed on the Altered Vehicle Worksheets.

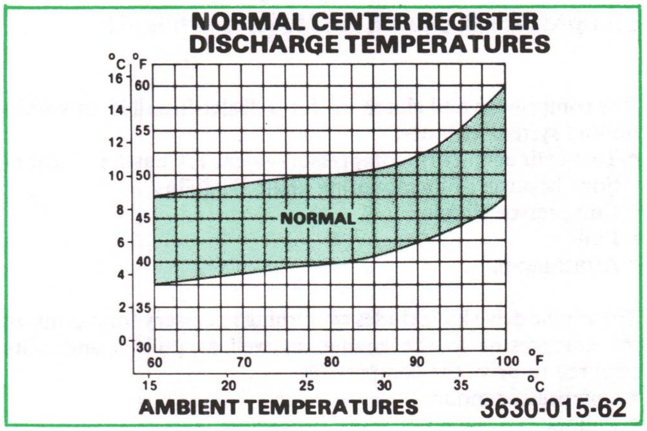


Fig. 62—Center Register Discharge Air Temperature Chart

Diagnosis and Servicing

Determining the Condition of a System Via Air Temperature at Registers

Figure 62 shows the range of center register discharge temperatures that would be considered "normal" for any given ambient temperature between 60°-100°F (15°-37°C). In order for the discharge reading to be accurate, however, these conditions must be met:
- Stabilized system pressures
- Stabilized in-car temperature between 70°-80°F (21°-27°C)
- Variable temperature control set for maximum cooling (recirculating A/C)
- Maximum blower speed
- 1500 engine RPM
- Compressor clutch engaged

Diagnosis

Dealer installed air conditioners use a temperature cycling refrigeration system with a thermal expansion valve (TXV) similar to the 1978-81 Econoline factory installation. As a result, they can be tested in essentially the same way, using discharge temperatures and high/low refrigerant pressures (discussed later) as the criteria for evaluation. The two main distinctions are:

- The adjustable temperature clutch cycling switch is available only on dealer installed recirculating systems
- No sight glass is provided with factory air conditioning.

When a customer claims unsatisfactory system operation, the first step to take is to test the center register discharge temperature under the testing conditions previously described.

NOTE: There is probably nothing wrong with the air conditioning installation if:

- There is adequate air flow from the registers
- The discharge air temperature is in the "normal" range

Look for other probable causes such as:

- Customer misunderstanding of control operation
- Warm air leaks into the passenger compartment

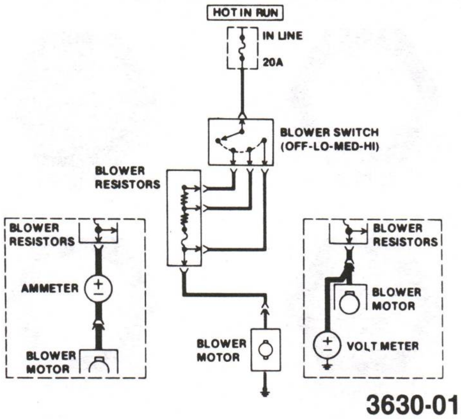


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Fig. 63—Diagnosis of Blower Motor Circuit

Three-speed Blower Motor-Diagnosis

The electric blower motor supplied with a dealer installed air conditioner has power side switching. A properly operating blower circuit will show increasing amperage readings as blower speed increases as shown in this chart:

SPEED	AMPERAGE
Low	3.6
Medium	7.9
High	15.9

No voltage in any switch position (motor does not run) indicates a broken circuit. Check the following:

- In-line supply fuse
- Ground contact from the blower motor
- Separated connector

No voltage in one or more positions:

- Check the switch
- Check the thermal limiter resistor assembly

Motor runs constantly at high speed. Switch has no effect. Check the following:

- Possible shorting across the switch terminals
- Possible direct connection to the blower, bypassing the switch

Motor runs only in the high speed switch location. Check the following:

- Thermal limiter in the motor resistor assembly

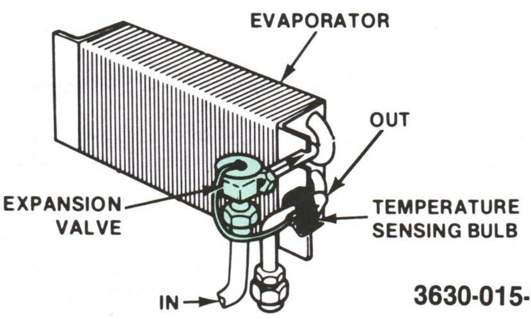

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Fig. 64—Thermostatic Expansion Valve (TXV)

Thermostatic Expansion Valve—Diagnosis

To test the operation of the thermostatic expansion valve, a manifold gauge set must be connected to the system. Then proceed as follows:

- Start the engine and run at fast idle (approx. 1500 RPM) with Maximum cooling and High blower speed for approximately 10 minutes
- Remove the insulation from the expansion valve temperature sensing bulb
- Remove the clamp and expose the bulb to the high engine compartment temperatures, or hold the sensing bulb in the palm of your hand. The expansion valve should open with very slight increase in compressor discharge pressure and an increase in compressor suction pressure
- Spray the temperature sensing bulb with liquid refrigerant. The expansion valve should close with a slight decrease in compressor discharge pressure and a large reduction in compressor suction pressure

The compressor pressures observed should be smooth and deliberate. If at any time, during the pressure change period, a hesitation followed by a jump in the pressure gauge readings occur, the system may be contaminated and require cleaning. Corrosion of the valve stem may also be interfering with proper expansion valve operation.

If the compressor discharge pressure does not increase or decrease as required, replace the expansion valve.

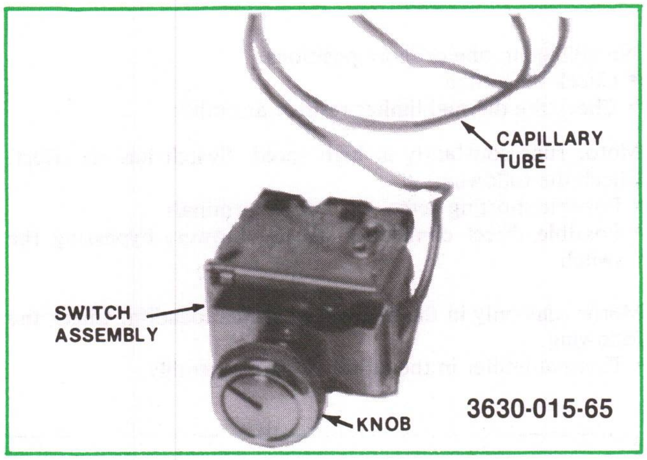


Fig. 65—Variable Temperature Clutch Cycling Switch

Variable Temperature Clutch Cycling Switch—Diagnosis

The variable temperature clutch cycling switch is driver adjustable, and is used with most dealer installed air conditioning systems.

The temperature sensing capillary tube is either inserted into the fins of, or attached to the evaporator core. The driver adjusts the desired temperature of the air from the evaporator by setting the temperature knob toward "cooler" or "warmer". A "cooler" setting allows the compressor to run for a longer period of time before cycling "off". As a result the evaporator becomes colder and can therefore cool the air passing through it more easily. A "warmer" setting will cause the compressor clutch to cycle "off" at a less cold evaporator temperature.

If a malfunction is suspected, check the operation of the switch in the following manner:

- Spray the capillary tube with R-12. The switch should open (no continuity).
- Use a self-powered test light or ohmmeter connected to the switch terminals to check that the switch opened.
- An ohmmeter check of the contacts when closed should show a resistance of less than one ohm. If a resistance of one ohm or more occurs, replace the switch.

NOTE:
With the control turned toward "MAX" setting, a longer spray should be required to open the switch than when the control is set to "MIN."

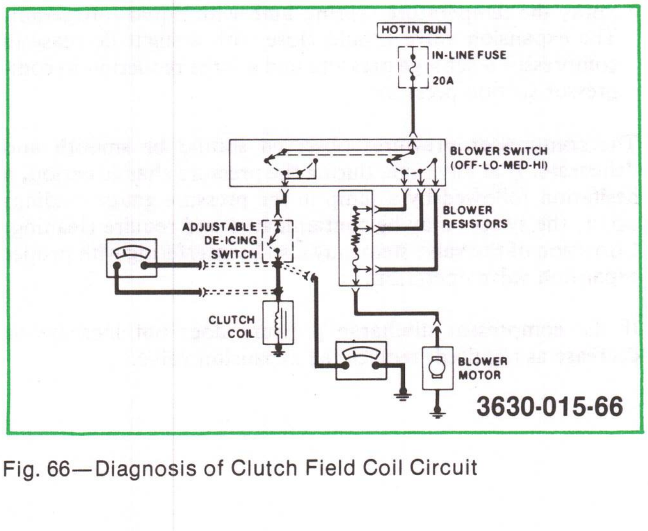


Fig. 66—Diagnosis of Clutch Field Coil Circuit

Conducting a Clutch Coil Circuit Test

To perform a magnetic clutch field coil circuit test:

- Check the fuse
- Disconnect the clutch field coil wire at the bullet connector near the compressor
- Connect a voltmeter between the clutch harness female connector and ground
- Turn on the blower switch to activate the system. Then, turn the ignition switch on ON. (The system will not operate when the ignition switch is in the accessory position.)
- The voltmeter should read battery voltage
- If voltage is available at the clutch harness female connector, perform a Magnetic Clutch Field Coil Current Test
- If no voltage is available at the clutch feed wire female connector, check the clutch cycling switch and the blower switch on the A/C control assembly for proper operation or disconnected wires

The variable temperature clutch cycling switch should be closed when the evaporator core temperature is above approximately 45 degrees F. The internal resistance of the switches should not exceed one ohm. Replace either switch if the contact resistance exceeds one (1) ohm with the contacts closed.

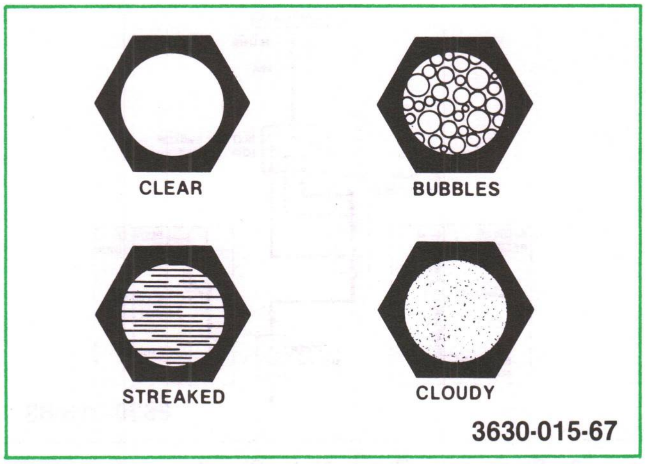


Fig. 67—Sight Glass Diagnosis of Refrigerant System

Using the Sight Glass as a Diagnostic Aid

Dealer installed air conditioners include a sight glass which allows observation of the refrigerant as it flows through the system. The appearance of the liquid can provide a tentative analysis of the condition of the refrigeration system, and can be used to charge the system, by watching until bubbles stop circulating. This is especially helpful when correct charge is unknown.

A clear sight glass can indicate:

- Correct refrigerant charge (continuous compressor operation)
- No refrigerant (immediately after clutch engagement)
- Too much refrigerant (immediately after clutch engagement)

Bubbles in the sight glass may indicate:

- Air in the system
- Low charge of refrigerant
- Normal operation (Under conditions of extremely high temperature)

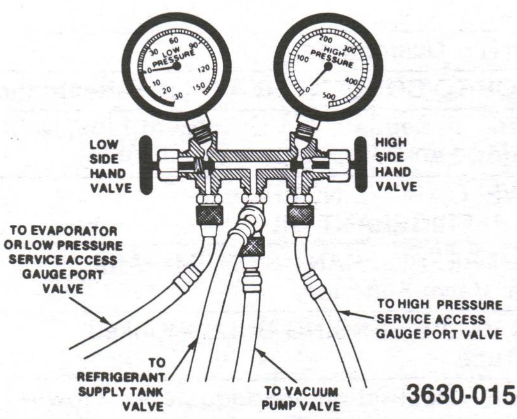
Streaks across the glass may be:

- Too much refrigerant oil in the system (Often found after compressor replacement if proper oil level was not established

in the new compressor).
- A lack of refrigerant, and compressor oil is circulating through the system

A cloudy sight glass indicates:
- The dry material in the receiver/drier has broken loose and is circulating through the system.

NOTE:
As a diagnostic aid, the sight glass is capable of providing only an **approximate** indication of the source of trouble. Firm conclusions can only be drawn after conducting appropriate tests and analyzing their results.


LOW PRESSURE
HIGH PRESSURE
LOW SIDE HAND VALVE
HIGH SIDE HAND VALVE
TO EVAPORATOR OR LOW PRESSURE SERVICE ACCESS GAUGE PORT VALVE
TO HIGH PRESSURE SERVICE ACCESS GAUGE PORT VALVE
TO REFRIGERANT SUPPLY TANK VALVE
TO VACUUM PUMP VALVE

3630-015-68

Fig. 68—Manifold Gauge Set

The Manifold Gauge Set

The manifold gauge set is used to measure high- and low-side refrigerant pressures while the air conditioner is operating. (NOTE: The service ports in dealer installed systems are at the compressor head fittings.)

The COMPOUND GAUGE, low-pressure side, measures both vacuum and pressure. It may also have scales for converting pressure/vacuum readings into relative evaporator temperatures for R-12, R-22, and R-502. Low pressure is also called "suction pressure," as it is measured at the compressor inlet.

The LOW-PRESSURE-SIDE CONTROL VALVE opens or closes the low-pressure side hose to the service hose for system charging. The gauge is open to the low-side hose at all times.

The HIGH-PRESSURE-SIDE GAUGE only measures pressure (in pounds-per-sq.-in.), and may have scales for converting readings into relative condenser temperatures for R-12, R-22, and R-502.

The HIGH-PRESSURE-SIDE CONTROL VALVE opens or closes the high-pressure hose to the service hose, and is used during system discharging. It does not affect pressure between the high-side hose and the gauge.

SERVICE HOSES to a vacuum pump and R-12 supply may be attached to the center manifold.

For testing be sure the vacuum pump hand valve is fully closed.

WARNING:
Do not open the high pressure side hand valve when the compressor is running, and a Refrigerant 12 can or tank is attached to the service hose. **High discharge pressures can burst the refrigerant container.**

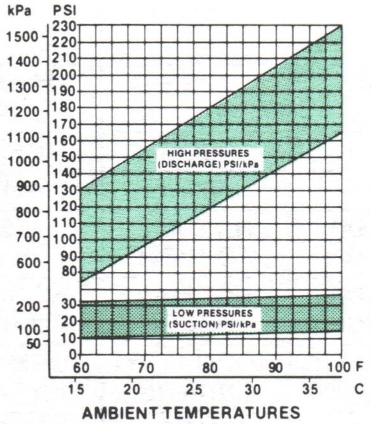


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Fig. 69—Normal Cycling Clutch Refrigerant System Pressures Chart

Evaluating System Operation Using Manifold Gauge Set Readings

Figure 69 shows the normal range of high-side and low-side pressure readings that can be expected in a cycling clutch refrigerant system for any given ambient air temperature between 60°-100°F (15°-37°C). Dealer installed systems are all of the cycling-clutch type.

With the engine stopped, connect the manifold gauge set to the refrigerant system, then start the engine and take the high and low pressure readings under the following conditions:
- Stabilized system pressures
- Stabilized in-car temperatures (@ 70°-80°F; 21°-27°C)
- Variable temperature control set for maximum cooling (recirculating A/C)
- Maximum blower speed
- 1500 engine RPM
- Compressor clutch engaged.

These conditions must be met to obtain accurate readings.

Note that "normal" readings for a particular ambient temperature can fall within a broad range of pressures. When abnormal readings are found, the Refrigerant System Pressure Evaluation Chart, Fig. 70, can be used to determine the possible causes.

By using the sight glass on the receiver/drier, the Normal Center Register Discharge Temperature Chart, the Normal Cycling Clutch Refrigerant System Pressures Chart, and the Pressure Evaluation Chart, most operating deficiencies within a refrigerant system can be pinpointed.

REFRIGERANT SYSTEM PRESSURE EVALUATION CHART FOR DE-ICING SWITCH CYCLING CLUTCH SYSTEMS

NOTE: Normal system conditional requirements must be maintained to properly evaluate refrigerant system pressures. Refer to chart applicable to system under test.

HIGH PRESSURE		LOW PRESSURE	POSSIBLE CAUSES
•LIQUID LINE	•COMPRESSOR		
HIGH	HIGH	HIGH	ENGINE OVERHEATING EXPANSION VALVE SENSING BULB—Poor Contact. Inadequate Insulation EVAPORATOR—Too Much Heat, Observe Conditional Requirements EXPANSION VALVE—Sticking Open
HIGH	HIGH	NORMAL TO HIGH	AIR IN REFRIGERANT SYSTEM
HIGH	HIGH	NORMAL	REFRIGERANT—Overcharge
HIGH	HIGH	LOW	COMPRESSOR-TO-CONDENSER A/C LINE-Restriction
NORMAL TO HIGH	NORMAL TO HIGH	HIGH	CONDENSER—Inadequate Air Flow (Bent Fins, Debris, Loose Radiator, Fan Belt, Slipping Fan Clutch)
NORMAL TO HIGH	NORMAL TO HIGH	NORMAL TO HIGH	HUMIDITY WELL ABOVE NORMAL EXCESSIVE REFRIGERANT OIL
NORMAL TO ERRATIC	NORMAL TO ERRATIC	NORMAL TO ERRATIC	MOISTURE IN REFRIGERANT SYSTEM—Affects Expansion. Valve Function.
ERRATIC	ERRATIC	ERRATIC	EXPANSION VALVE SENSING BULB—Kinked Capillary Tube
NORMAL TO LOW	NORMAL TO LOW	NORMAL TO LOW	EVAPORATOR—Restriction, Inadequate Air Flow—Reset Blower to Conditional Requirement and/or Confirm Blower Condition.
LOW	HIGH	LOW	RECEIVER/DRIER—Restriction A/C LIQUID LINE—Restriction CONDENSER—Restriction
LOW	LOW	HIGH	A/C SUCTION LINE—Restriction SUCTION ACCUMULATOR—Restriction COMPRESSOR—Damaged Valves—(Inadequate compression)
LOW	LOW	LOW	A/C SUCTION LINE—Restriction SUCTION ACCUMULATOR—Restriction EVAPORATOR—Iced-up/CONDENSER—Plugged RECEIVER/DRIER—Plugged/A/C LIQUID LINE—Restriction EXPANSION VALVE SENSING BULB—Perforated Bulb/EXPANSION VALVE—Sticking Closed REFRIGERANT LEAK AND/OR UNDERCHARGE COMPRESSOR-TO-CONDENSER A/C LINE-Restriction DE-ICING SWITCH—Sticking Closed/COMPRESSOR CLUTCH—Seized

ADDITIONAL POSSIBLE CAUSE COMPONENTS ASSOCIATED WITH INADEQUATE COMPRESSOR OPERATION

COMPRESSOR CLUTCH—Slipping/COMPRESSOR DRIVE BELT—Loose
CLUTCH COIL—Shorted coils; Slipping/CLUTCH COIL—Open Circuit/Blown Clutch Circuit Fuse
DE-ICING SWITCH—Sticking Open/Improper Clutch Circuit Contact in Control Assembly Switch

ADDITIONAL POSSIBLE CAUSE COMPONENTS ASSOCIATED WITH A NON-FUNCTIONAL COMPRESSOR

DE-ICING SWITCH—Sticking Closed/COMPRESSOR CLUTCH—Seized/REFRIGERANT LEAK

Fig. 70—Refrigerant System Pressure Evaluation Chart

3630-015-70

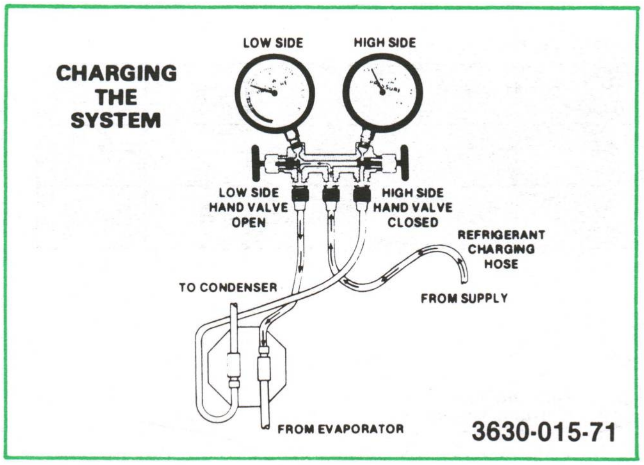


Fig. 71—Charging the System

Discharging, Evacuating, Purging, and Charging the System

DISCHARGING

Follow the normal shop manual safety practices and approved procedures for discharging factory installed A/C systems in E-100-350 Series light trucks to discharge a dealer installed system.

1. Connect manifold gauge set, Fig. 71.
2. **Slowly** discharge from the low pressure gauge valve into a garage exhaust outlet to minimize refrigerant oil loss from the system
3. Slowly open high pressure gauge valve to discharge any remaining refrigerant

EVACUATING

To ready the system for charging:

1. Attach a tank of refrigerant and a vacuum pump
2. Open both low and high pressure gauge valves
3. Run the vacuum pump until gauge reads between 25 and 30 inches of vacuum.
4. Continue pump operation for 20-30 minutes
5. Close both gauge valves and turn pump off

NOTE:

The gauge reading (low side gauge) should remain at the same vacuum reading. Any change indicates a leak . . . conduct a leak test.

PURGING GAUGE HOSES

To minimize the presence of atmosphere moisture and air, purge the manifold gauge charging hose by:

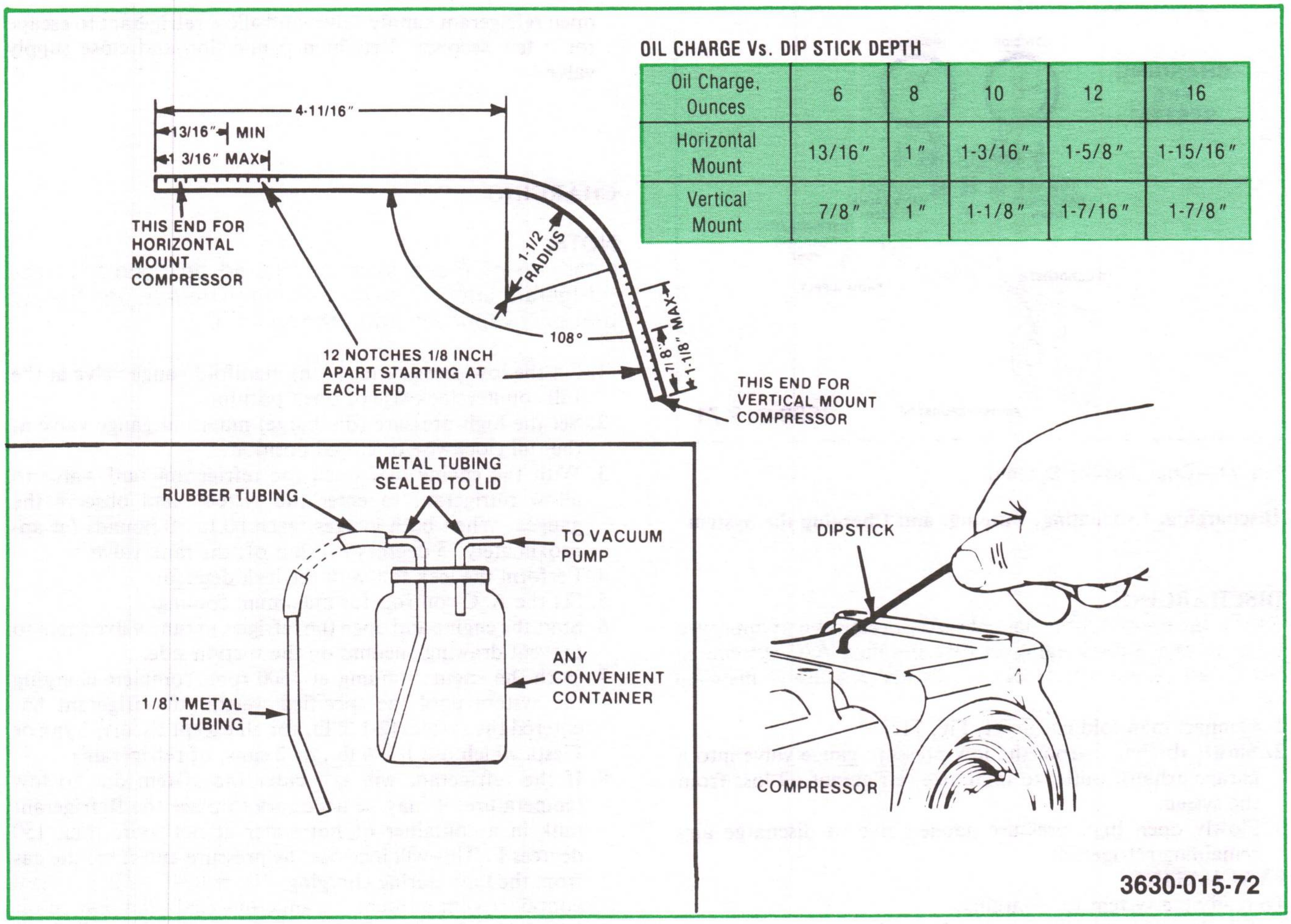
- Loosen charging hose slightly at manifold connection. Slowly open refrigerant supply valve, and allow refrigerant to escape for a few seconds. Retighten connection and close supply valve.

CHARGING

NOTE:

Charging of these systems should be done with the refrigerant supply can or tank in the upright position so that only vapor will enter the system.

1. Set the low pressure (suction) manifold gauge valve at the full counterclockwise or open position.
2. Set the high pressure (discharge) manifold gauge valve at the full clockwise or closed position.
3. With the engine off, open the refrigerant tank valve to allow refrigerant to enter the system, and observe the gauges. When both gauges reach 60 to 80 pounds (at approximately 75 degrees F.) shut off the tank valve.
4. Perform the leak test with the leak detector
5. Set the A/C controls for maximum cooling.
6. Start the engine and open the refrigerant tank valve again to prevent drawing vacuum on the suction side.
7. With the engine running at 1500 rpm, complete charging the system until the specified weight of refrigerant has entered the system (2-1/2 lb. for all except Escort, Lynx or Fiesta which use 1-3/4 lb., or 2 cans, of refrigerant)
8. If the refrigerant will not enter the system due to low temperature, it may be necessary to place the Refrigerant tank in a container of hot water at not more than 150 degrees F. This will increase the pressure and force the gas from the tank during charging. Never heat the Refrigerant container with a torch. A dangerous explosion may result
9. During the charging, the high pressure (discharge) side may build up to an excessive value. This can be caused by an overcharge of refrigerant, or an overheated engine, in combination with high surrounding temperatures. Never allow the high pressure to exceed 240 pounds while charging. If it does, stop the engine, determine the cause, and correct it.
10. After the proper charge has been made, close the Refrigerant tank valve, and check the system pressures for proper operation. (Low pressure suction gauge 4-25 psi; high pressure discharge gauge 120-170 psi at 70 to 90 degrees F ambient)
11. After satisfactory operation has been achieved, disconnect the manifold gauge set high and low pressure hoses from the service valves.
12. Install caps on the service valves and the manifold gauge set hoses.



OIL CHARGE Vs. DIP STICK DEPTH

Oil Charge, Ounces	6	8	10	12	16
Horizontal Mount	13/16"	1"	1-3/16"	1-5/8"	1-15/16"
Vertical Mount	7/8"	1"	1-1/8"	1-7/16"	1-7/8"

Fig. 72—Checking Oil on Horizontal Mounted York Compressor

Under normal conditions, when the air conditioning system is operating satisfactorily, the compressor oil level need not be checked. There is no place for the oil to go except inside the sealed system. Check the compressor oil level only if any portion of the refrigerant system is being replaced, or if there was a leak in the system and the refrigerant is being replaced.

1. After the system has been charged, operate the system for about ten minutes or until the pressures have been stabilized in a surrounding temperature of 60°F or above.
2. Stop the engine. And discharge the system.
3. Remove the oil filler plug from the compressor. Insert a flattened 1/8 inch diameter rod in the oil filler hole until it bottoms. The dipstick must be wiped completely clean before insertion. If necessary, slightly rotate the compressor crankshaft by hand so that the dipstick will clear the crankshaft.
4. Pull out the dipstick, and check the oil indication. Refer to chart in Fig. 72. It should show at least the minimum amount of oil (6 ounces). If the oil level is low, add oil, (Ford Part C9AZ-18577-B or Motorcraft YN-2 or equivalent). If too much oil is indicated (more than 10 ounces) proceed as follows:
   —Draw out all of the oil using a trap similar to that shown in Fig. 72, or remove the compressor from the vehicle and pour the oil out of the crankcase.
   —Add approximately six ounces of oil to the crankcase, and replace the filler plug. Reinstall the compressor, if it was removed.
5. Replace the oil fill plug. Evacuate and charge the system.
6. Check the compressor filler plug area for leaks with a leak detector.

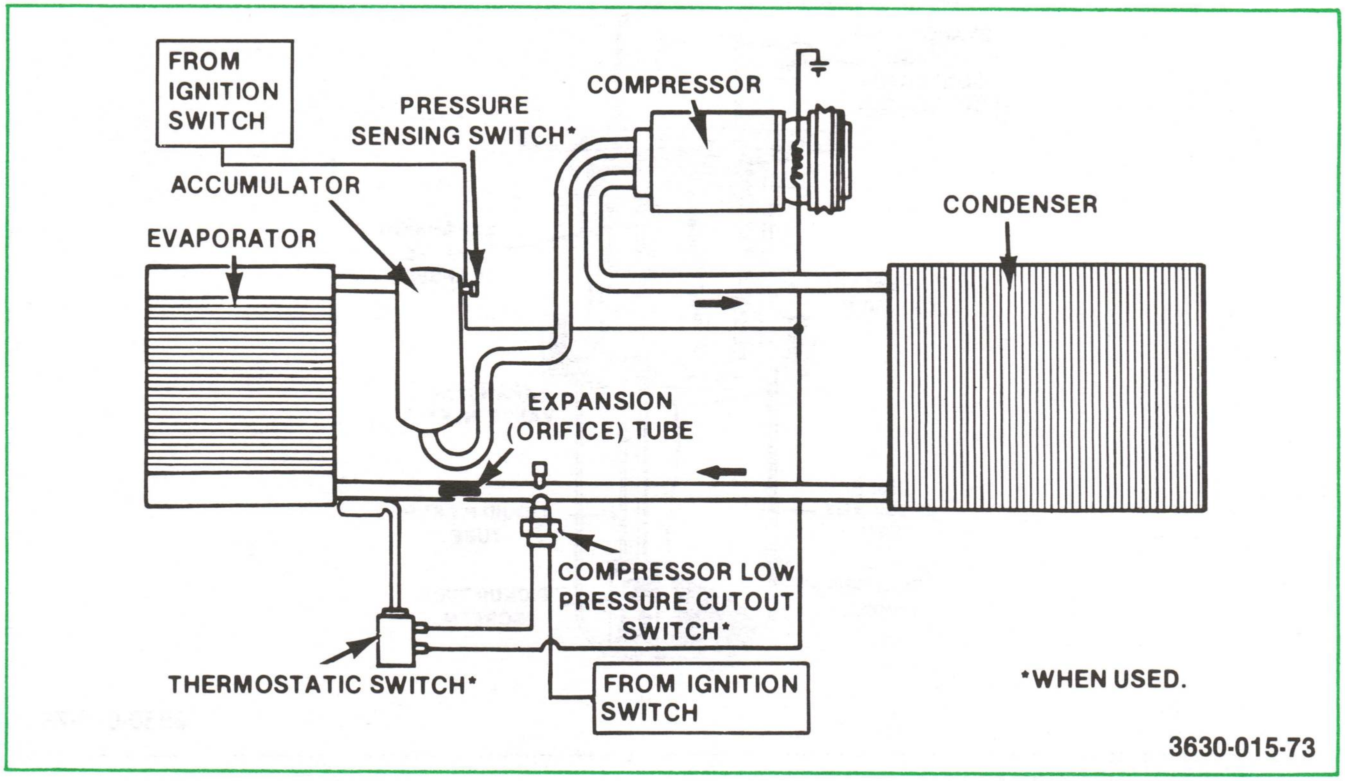


Fig. 73—GM "CCOT" System

GM "CCOT" System (Cycling Clutch Orifice Tube)

The G.M. "CCOT" (**C**ycling **C**lutch **O**rifice **T**ube) system is a cycling-clutch type air conditioning system that has two major differences from the thermostatic switch type: (1) it uses an accumulator on the outlet (low pressure) side of the evaporator instead of a high-pressure side receiver/drier; (2) it uses an expansion tube instead of an expansion valve.

The accumulator's primary function is to separate any liquid refrigerant which may flow out of the evaporator and keep it from reaching the compressor. The accumulator, like the receiver/drier, also stores excessive R-12 and filters and dries the refrigerant.

G.M. uses this accumulator system for many applications. Some of the older versions have a standard thermostatic switch which turns the compressor on and off. In newer installations, a pressure-sensing cycling switch, mounted in the suction accumulator, controls compressor operation.

In Fig. 73, note the location of the Thermostatic Switch and the Pressure Sensing Switch (remember that both are clutch cycling switches). The compressor low pressure cutout switch protects the system against continued operation with inadequate refrigerant and is not used when a pressure sensing switch is installed. Both switches perform a similar function and therefore are not needed together in the same system.

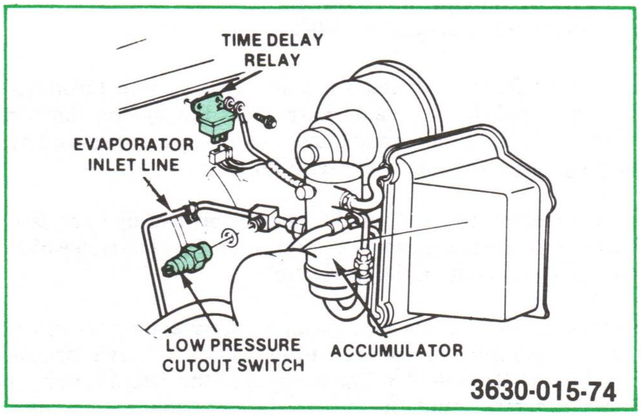


Fig. 74—Low Pressure Cut-Out and Time-Delay Relay Switches

A low pressure cut-out switch is used on CCOT systems that do not have a pressure sensing switch. Located in the evaporator inlet line (high side), or in the rear head of the compressor, the cut-out switch senses insufficient R-12 pressure and opens electrically to stop the compressor. This switch also acts as an ambient temperature switch since pressure within it varies according to ambient temperature; it will not allow compressor operation at very low temperatures.

On some G.M. vehicles, when the air conditioning system is turned on immediately at engine start-up, a time-delay relay postpones compressor operation 10-25 seconds to allow time for purging the fuel evaporation canister and to prevent compressor clutch chatter which sometimes accompanies cold engine start. This relay is normally found on smaller engines.

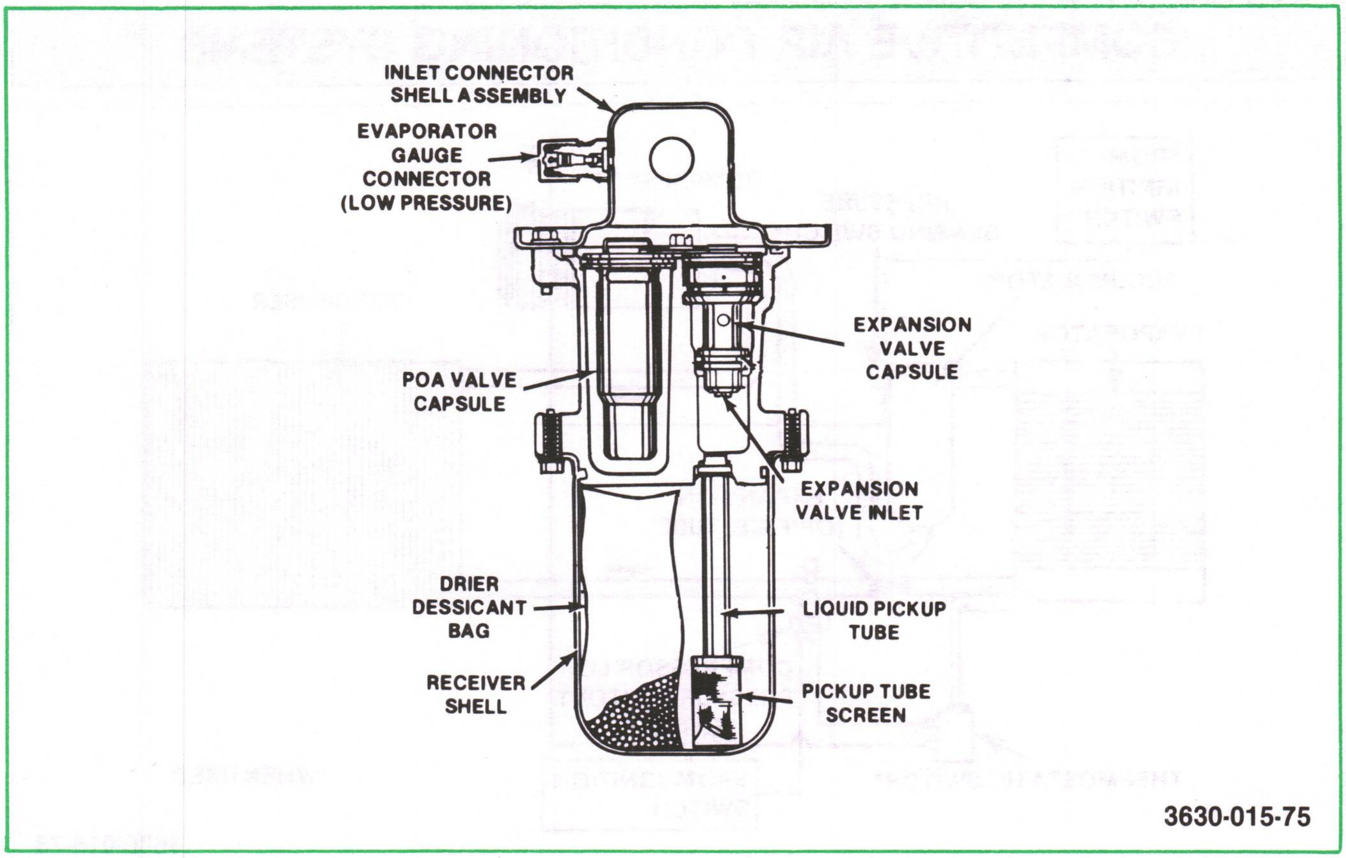


Fig. 75—GM POA Valve and VIR Assembly

GM POA (Pilot Operated Absolute) Valve-in-Receiver Assembly (VIR)

The POA (Pilot Operated Absolute) type suction throttling valve accomplishes the same purpose as the suction throttle valve "STV"— it senses and maintains evaporator pressure by opening and closing in response to pressure.

In this assembly the receiver/drier can be opened-up to replace valves, to replace dessicant or to remove foreign material which may have collected on the filter screen.

Starting in 1975, some GM products were equipped with a slightly redesigned VIR assembly, called an Evaporator Equalized VIR (VIR-EE). The purpose of the design is to help eliminate temperature fluctuation during some A/C modes. The result is smoother power use and better fuel consumption during A/C operation.

The change was in the area of the Expansion Valve. The equalizer port, formerly between the wall of the POA and expansion valve, was moved to the expansion valve body. The "O" rings were removed and a new color coding used to identify the new valve. With the port on the expansion valve, evaporator outlet pressure can be sensed directly by the expansion valve and give a faster reaction to pressure changes.

The newer expansion valve is a gold color and a red label is affixed to the receiver shell to identify the VIR-EE unit. A VIR-EE expansion valve is not interchangeable with the former type.

Another modification to the expansion valve allows it to remain slightly open instead of closing completely. This allows a constant partial flow of refrigerant into the evaporator. It helps prevent freezing at the expansion valve (which clogs the system and stops operation) and provides a constant supply of refrigerant oil to lubricate rotary compressors.

The VALVES-IN-RECEIVER type system (VIR/VIR-EE) is used exclusively by General Motors (although not all GM products use this type of system).

In this system, the controls (expansion valve and pilot operated absolute valve "POA" suction throttling valve) are located in one housing with the receiver-drier. This unit is mounted in the high pressure side between the condenser and evaporator inlet.

As with the standard suction throttling valve type system, the Valves-in Receiver type also allows compressor operation in any "ON" mode, with the VIR unit controlling refrigerant flow.

The VIR assembly combines the thermostatic expansion valve, POA valve, filter-drier, and sight glass into one integral unit. It is mounted adjacent to the evaporator. This design eliminates the external equalizer line between the expansion valve and the POA valve. The thermo bulb and capillary line for the expansion valve is eliminated because the diaphragm end of the expansion valve is now directly exposed to the refrigerant vapor entering the VIR from the evaporator outlet. The sight glass is in the valve housing at the inlet of the expansion valve.

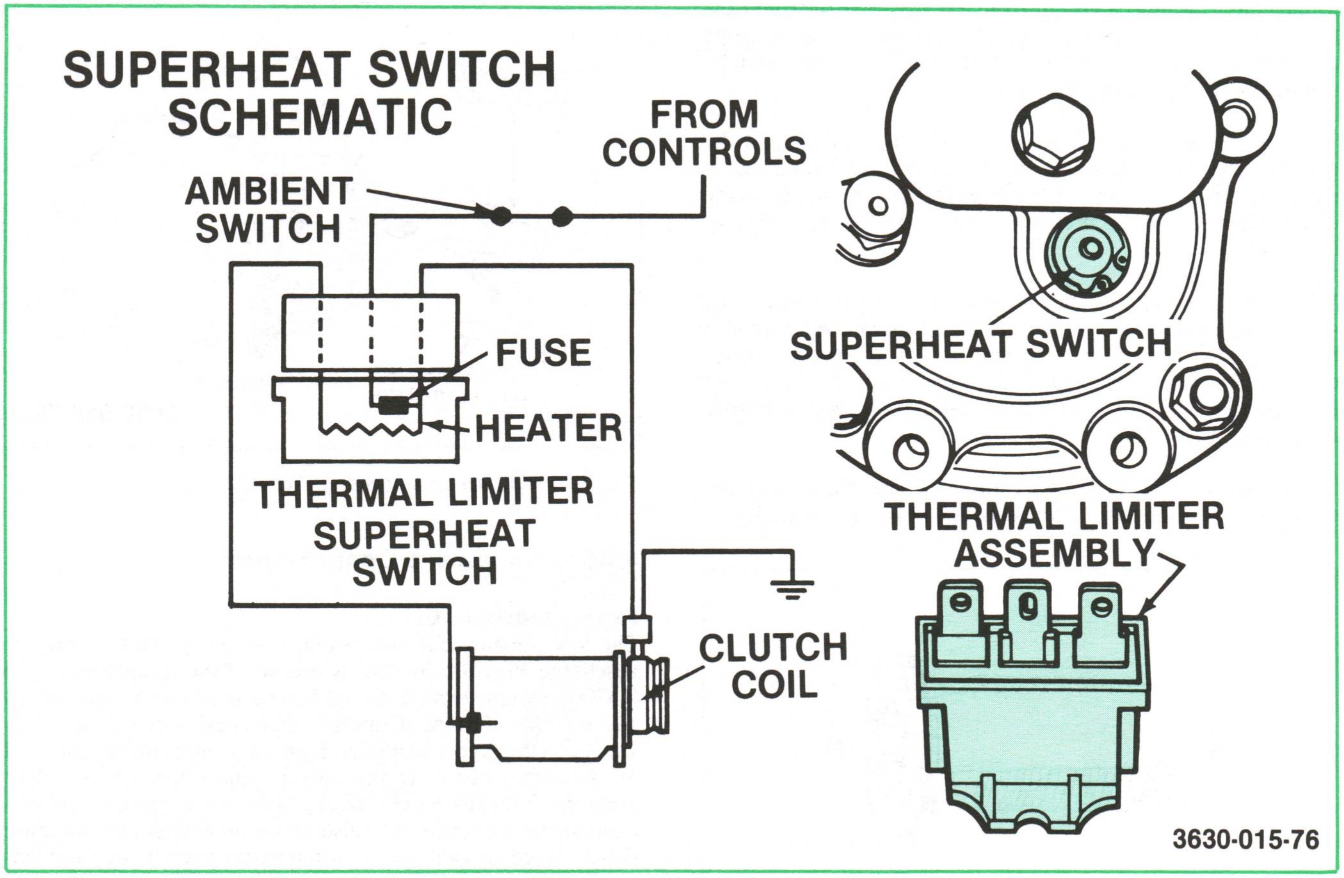


Fig. 76—Thermal Limiter Assembly and Superheat Switch

Thermal Limiter and Superheat Switch

This low refrigerant protection system is used on some General Motors systems (with VIR or VIR-EE). It stops compressor operation in the event of a low-charge state. The superheat switch, which senses the low pressure and activates the system, is located in the rear compressor head. The thermal limiter is a special fuse which will melt when it receives a signal from the superheat switch. This breaks the electrical connection to the compressor clutch and the system is protected against damage.

When correcting a low refrigerant charge condition which has blown the thermal limiter, replace the limiter AFTER the system has been restored to normal operation.

From 1975, some thermal limiters were designed with a higher melting point. This is to prevent accidental blowing of the limiter when a momentary pressure fluctuation occurs due to extreme operating conditions and not due to a system malfuction.

While doing service work on the system it is a good idea to use a jumper wire to bypass the thermal limiter because the fuse tends to blow very easily.

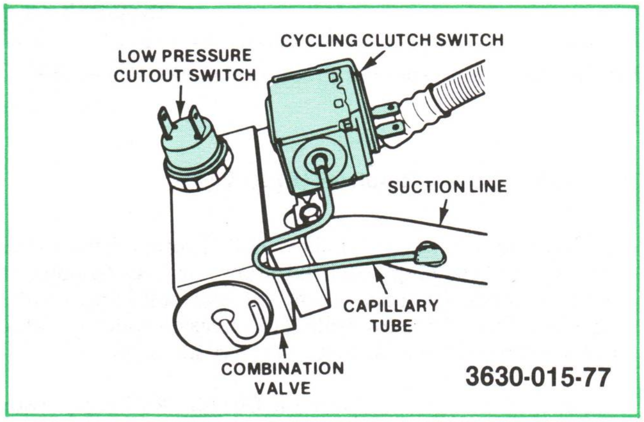


Fig. 77—Chrysler Cycling Clutch and Low Pressure Cut-Out Switches

Chrysler Systems and Components

Chrysler Cycling Clutch and Low Pressure Cut-Out Switches

The cycling clutch switch is located on the refrigerant plumbing sealing plate (combination valve area) and is electrically in series with the compressor clutch coil. It is an on-off switch which turns the compressor on and off depending on the temperature sensed by the capillary tube. The capillary tube is inserted into a well located on the suction line, Fig. 77. The well is filled with a special grease that is required for proper switch sensing. The switch is a sealed, calibrated unit and if found defective, must be replaced.

Rapid clutch cycling can result from a faulty valve or from Low Pressure Cut-Off Switch action when system pressure drops due to low ambient temperature (25°F, —4°C or lower) and the engine idles for prolonged periods.

The Low Pressure Cut-Off Switch, which is located on the combination valve, is wired in series with the compressor magnetic clutch. It cuts off the electrical power supply to the clutch when refrigerant pressure drops below the control point of the switch.

Whenever the system is inactivated by the low pressure cut-off switch due to the loss of refrigerant, refrigerant oil may also have been lost. Therefore, to prevent damage to the compressor due to operation without sufficient lubrication, the leak must be repaired and the compressor oil level checked before recharging the system.

The switch is a sealed, factory calibrated unit. No adjustment or repair is possible. A defective switch must be replaced.

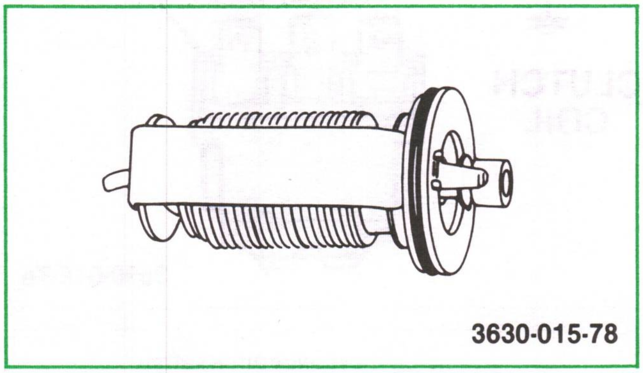


Fig. 78—Chrysler Evaporator Pressure Regulator Valve (EPR)

Evaporator Pressure Regulator (EPR) Valve

The Evaporator Pressure Regulator (EPR) valve maintains the temperature of the evaporator just above the freezing point of the water condensing out of the air and collecting on the evaporator fins. If not controlled, the freezing water can plug and restrict the flow of air through the evaporator.

The EPR valve is only used with the Chrysler RV2 compressor and is installed in the compressor suction port. (A clutch cycling switch is used with the C-171 rotary compressor.) A normally functioning EPR valve will be wide open and the pressure drop across it will be 6 PSIG or less when the system is stabilized.

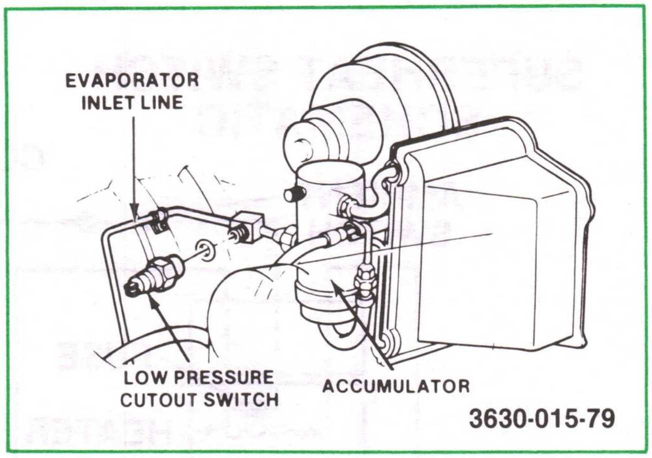


Fig. 79—AMC Air Conditioning (Typical)

AMC Systems and Components

Factory Installed—Car

The low pressure cut-out switch, also called the Compressor Discharge Pressure Switch, is used on GM accumulator-type (CCOT) systems which do not have a pressure sensing switch and on 1980-1981 AMC models with 4-cylinder engines. It is located in the evaporator inlet (high side) line or in the rear head of the compressor. If the switch senses a very low R-12 pressure, it opens to electrically stop the compressor clutch from operating. The switch also acts as an ambient temperature switch, since pressure at the switch varies directly with ambient temperature. (It will not allow compressor operation at very low temperatures.)

Also included with the 4-cylinder engine is a vacuum full throttle cut-out switch, to allow full engine power for passing or on hills.

The factory installed air conditioning system is mostly recirculating, since only a small percentage of outside air is drawn-in. It does however use a "blend" door to regulate temperature. Heat is regulated by a vacuum operated hot water valve into the heater, and a standard capillary tube de-icing switch is used to prevent evaporator "freeze-up."

The current receiver/drier includes a desiccant to remove moisture and a sight glass for diagnosis and charging of the system.

The York compressor is used on all engines except the 6 cylinder engine in California. A Sankyo is used with 6 cylinder engines in California.

Aftermarket Units—Car
A Sankyo compressor is used in most aftermarket installations; along with a receiver/drier and full throttle cutout with the 4-cylinder engine.

Factory Installed—Jeep
The Jeep factory A/C refrigeration installation is the same as for the car except the sight glass is moved from the receiver/drier to an in-line installation. It is in the high pressure line and is mounted to the wheel well.

Once again, the York compressor is used in all applications except that the Sankyo compressor is used in California with the 6-cylinder engine. Temperature control is by an adjustable thermostatic clutch cycling switch.

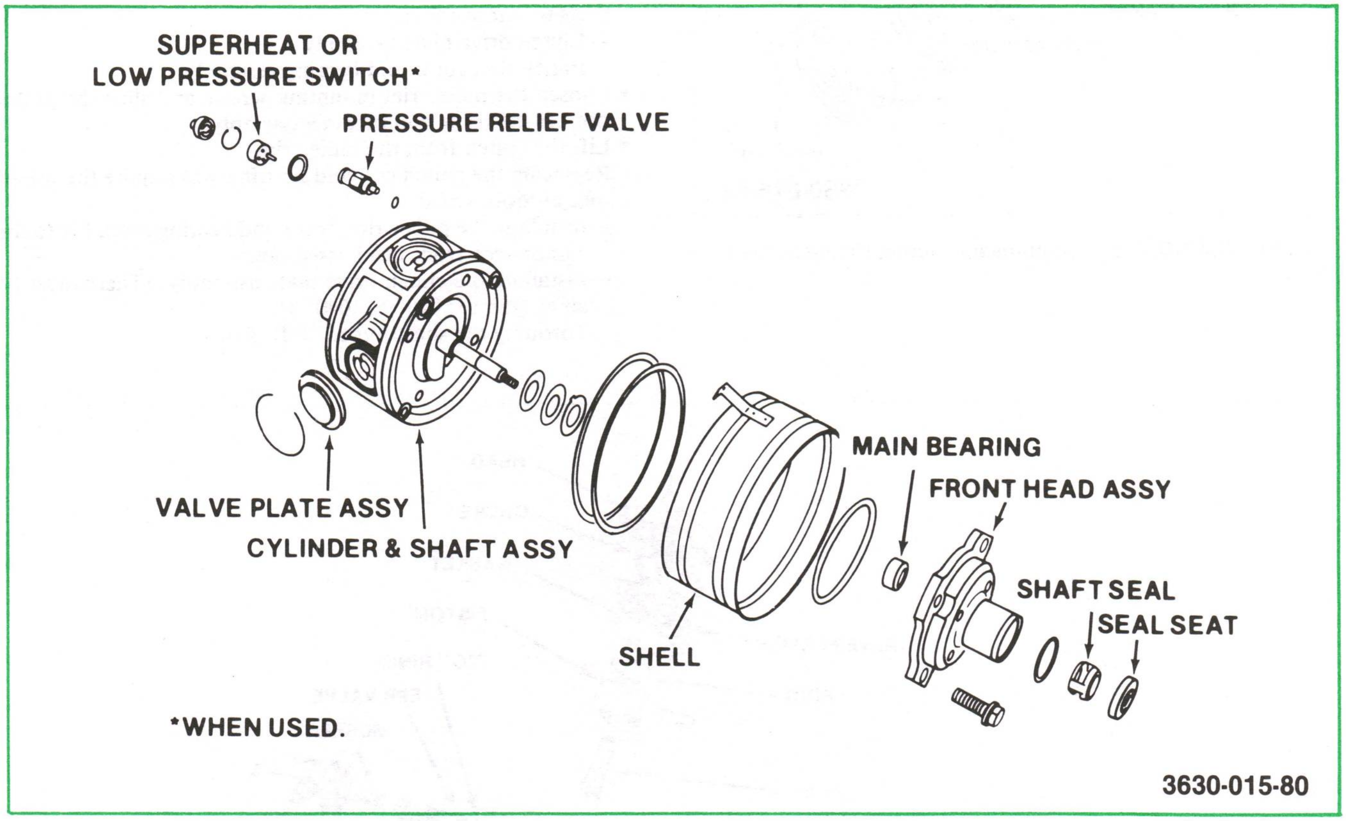


Fig. 80—GM 4-Cylinder Compressor, Disassembled View

GM 4-Cylinder Compressor Components

The four-cylinder Frigidaire compressor is a radial-design unit. The basic compressor mechanism is a modified yoke with four cylinders located radially in the same plane. Opposed pistons are pressed into a yoke which rides on a slider block on the shaft eccentric. Rotation of the shaft provides piston motion without connecting rods. No oil pump is used as compressor lubrication is provided by piston movement and the refrigerant oil circulating in the system. Reed valves for suction and discharge are provided for each cylinder.

A pressure relief valve is located on the rear of the compressor to provide pressure bleed off under high pressure conditions.

Some systems have a "superheat switch" or low pressure switch mounted on the rear compressor head. These switches are designed primarily to stop compressor operation if the refrigerant charge is too low. The superheat switch senses the high heat condition caused by low refrigerant levels. The low pressure switch senses the pressure drop caused by a loss of refrigerant.

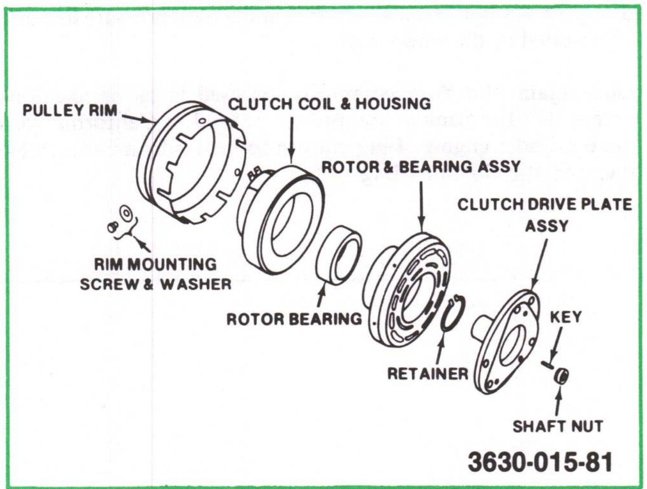


Fig. 81—GM 4-Cylinder Compressor Clutch, Disassembled View

Clutch Assembly Components

The GM 4-cylinder compressor clutch and pulley assembly is substantially different in appearance from the Warner and Nippondenso clutches used by Ford.

The stationary coil is mounted on the face of the compressor, but is within the pulley rim, rotor and bearing assembly.

- Removing the clutch coil and housing requires use of special tools to remove the:
  —Clutch drive plate assembly
  —Pulley rim, rotor and bearing assembly
- Loosen the pulley rim mounting screws and slide the pulley rim off the rotor and bearing assembly
- Lift the clutch from the pulley rim
- Replacing the clutch coil and housing will require the use of special tools when:
  —Installing the pulley rim, rotor and bearing assembly to the compressor front head assembly.
  —Installing the clutch drive plate assembly. (There must be an air gap of .020″ to .040″.)
  —Torquing the shaft nut to 10 ft.-lbs.

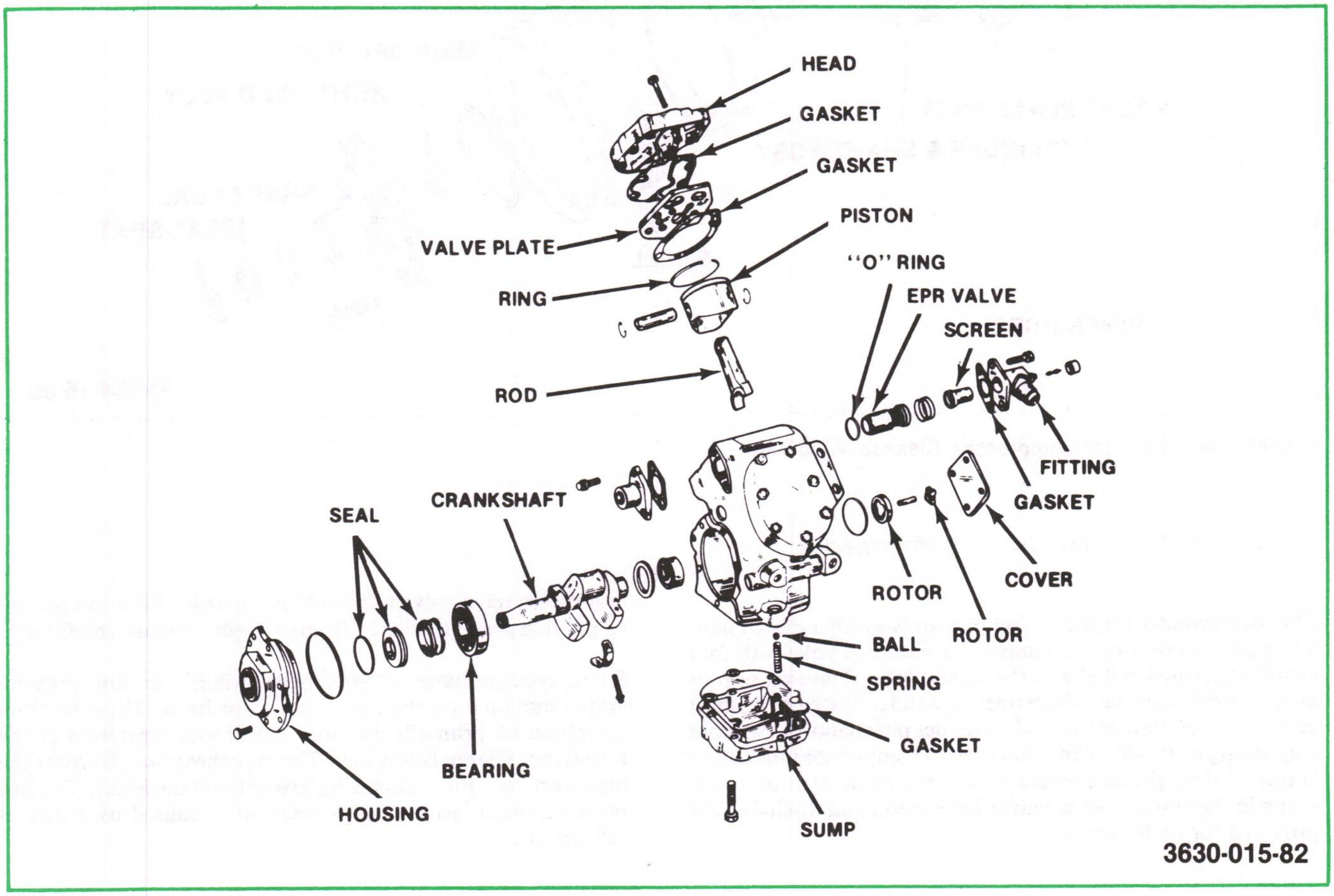


Fig. 82—Chrysler RV-2 Compressor, Disassembled View

Chrysler RV-2 Compressor and Components

The RV-2 compressor is a two-cylinder, reciprocating-type air conditioning compressor. Service parts are available so that the compressor can be repaired.

Some parts are serviced individually and some are serviced in packages which include two or more service parts.

When servicing the RV-2 compressor keep the following items in mind:

1. Before disassembling the compressor, clean the exterior surfaces thoroughly.

2. Complete disassembly and reassembly of the compressor must be performed with the compressor removed from the vehicle. The valve plate and crankshaft seal assemblies can be repaired with the compressor installed on the vehicle.
3. Clean all parts thoroughly before reassembly.
4. Do not use air to dry the crankshaft front main bearing. Wash bearing in clean mineral spirits and shake out all excess cleaning solution. Saturate bearing with clean refrigerant oil and assemble immediately. Any dirt in the front main bearing will cause noisy operation and possible bearing failure.
5. Before reassembly of any part, all contact surfaces must be coated with clean refrigerant oil.

Complete disassembly of the compressor can be accomplished with normal hand tools. Likewise, assembly is possible without using special tools; except pilot studs are recommended for installing the cylinder head and valve plate assembly or the sump and gasket to the housing.

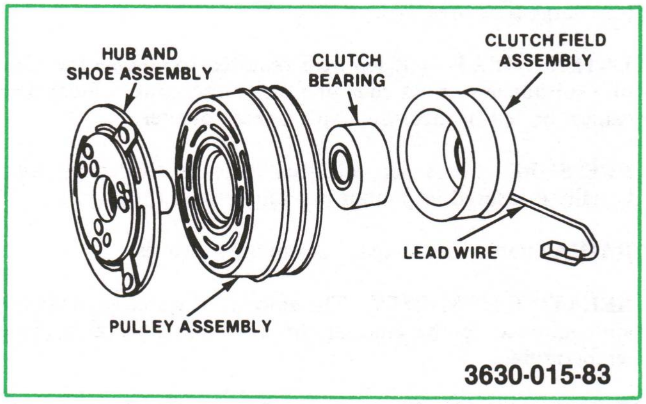


Fig. 83—Chrysler RV-2 Compressor Clutch, Disassembled View (Typical)

RV-2 Compressor Clutch

COMPRESSOR CLUTCH & PULLEY ASSEMBLY—REMOVAL:

1. Loosen and remove the belts. Disconnect clutch field lead wire at the connector.
2. Remove the special locking bolt and the washer from the compressor crankshaft at the front center of the clutch.
3. Insert a 5/8 in.—11 × 2-1/2 in. cap screw into the threaded portion of the hub assembly.
4. Support clutch with one hand, then tighten cap screw until clutch is removed.
5. Remove the three hexagon head screws attaching the clutch field assembly to the compressor and lift off the assembly.

INSTALLATION

1. Install clutch field coil assembly on the base of compressor bearing housing. Make sure coil assembly is positioned so lead wire points to left of compressor as viewed from the front. Install the three mounting screws and tighten to 24 inch-pounds (3 N·m).
2. Insert clutch assembly on crankshaft.
3. Install washer and a new self-locking bolt. Hold clutch from turning with a spanner wrench inserted in the holes of front plate. Tighten to 20 foot-pounds (27 N·m).
4. Check to make sure the pulley turns freely, and is not binding.
5. Connect field lead wire.
6. Install belts.

DISASSEMBLY

1. Place the pulley and hub assembly face down in a press. Support the face of the pulley, allowing clearance for the hub to pass through.
2. Using an arbor that will pass freely through the bearing, press out the hub. NOTE: Some earlier clutch models used snap rings to retain the hub in the bearing. Make sure the snap ring is removed prior to attempting to remove the hub.
3. Inspect the bearing retention to the pulley, remove any snap rings that may be present (not used on later models).
4. Turn the drive pulley face up and press-out the bearing with a suitable size arbor. NOTE: A new bearing must be installed every time the magnetic clutch is disassembled.

ASSEMBLY

1. Carefully remove any excess staking material from the hub and pulley assemblies with a small file.
2. Press a new bearing into the pulley hub, and reinstall any retaining rings which may have been removed previously.
3. Start the drive hub into the inner bearing race, and while supporting the pulley hub carefully press the drive hub into position with an arbor press. CAUTION: Do not allow the drive hub to become "cocked" during installation into the bearing.
4. Using a 3/8 flat faced drift punch, apply six (3 inner and 3 outer) stakes, each indexed approximately 60° from the previous stakes. The stake should protrude toward the race approximately 15° to lock the bearing securely. NOTE: This procedure applies only without snap rings. If snap rings are used in the clutch being serviced, DO NOT STAKE the bearing into place.

CAUTION:

The pulley assembly and hub assembly are mated parts. They are burnished at the factory before shipment. No attempt should be made to replace either unit separately as this is likely to reduce the initial torque of the clutch.

GLOSSARY OF TERMS

ABSOLUTE HUMIDITY—The actual amount of water vapor in a given volume of air; for example, grams of water per cubic foot of air.

ABSOLUTE PRESSURE—A pressure scale having as its zero point the complete absence of pressure. Atmospheric pressure on the absolute scale is 14.7 psi or 29.92 inches of mercury (Hg).

ABSOLUTE ZERO—The complete absence of heat which would occur at zero degrees absolute or minus 460 degrees Fahrenheit.

ATMOSPHERIC PRESSURE—The pressure on all objects in the atmosphere due to the weight of the air which makes up the atmosphere. Atmospheric pressure at sea level is 14.7 psi absolute and decreases as altitude increases.

BOILING—Conversion from the liquid to vapor state which takes place throughout the liquid and is accompanied by bubbling as the vapor below the surface rises.

BRITISH THERMAL UNIT (BTU)—The amount of heat necessary to raise the temperature of one pound of liquid water one degree Fahrenheit. The measure of heat **quantity**.

1 BTU = 778 pound feet or 252 calories

CAPILLARY TUBE—A tube with a very small inside diameter.

COEFFICIENT OF EXPANSION—The percent of increase in length per degree of temperature rise. An aluminum bar lengthens 13 millionths percent of the original length for each degree (F.) of temperature rise.

COMPRESSION—Reducing the volume of gas by squeezing it into a smaller space. Increased pressure and temperature always accompany compression.

COMPRESSOR—A machine for squeezing a vapor into a smaller space so as to raise the vapor pressure and temperature.

CONDENSATION—Conversion from the vapor to the liquid state.

CONDENSER—A heat exchanger in which a vapor is changed to the liquid state by removing heat from the vapor.

CONDUCTION—The transfer of heat between the closely packed molecules of a substance or between two substances that are touching.

CORROSION—Chemical action, usually by an acid, that decomposes a metal.

DEHUMIDIFY—To remove water vapor from the air.

DISCHARGE PRESSURE—Pressure at the compressor outlet (head pressure).

EVAPORATION—Conversion from the liquid to the vapor state at the surface of the liquid only. It can occur at temperatures below the boiling point.

EVAPORATOR—A heat exchanger in which the liquid refrigerant absorbs heat and boils. The heat is transferred to the refrigerant from the air passing over the evaporator.

EXPANSION VALVE—A metering device that controls the amount of refrigerant sprayed into the evaporator and controls expansion of the refrigerant in the evaporator.

GAUGE PRESSURE—A pressure scale which ignores atmospheric pressure. Atmospheric pressure of 14.7 psi absolute is zero psi gauge.

HEAD PRESSURE—Pressure at the compressor outlet (discharge pressure).

LATENT HEAT—Hidden heat required to change the state of a substance without changing the temperature. Latent heat cannot be felt or measured with a thermometer.

PRESSURE—Force per unit area or force divided by area. Usually measured in pounds-per-square-inch (psi).

RADIATION—The transfer of energy in waves.

RELATIVE HUMIDITY—The amount of water vapor in the air compared to the amount the air could hold at a given temperature.

SPECIFIC HEAT—The quantity of heat in BTU's required to change the temperature of one pound of a substance one degree F.

SUCTION PRESSURE—Pressure at the compressor or inlet.

SUCTION SIDE—The low pressure inlet side of the compressor.

SUPERHEATED VAPOR—A vapor that is not in contact with the generating liquid, and that has a higher temperature than the saturated vapor at the same pressure.

TEMPERATURE—The measure of heat **intensity** or **concentration** in degrees. Temperature is **not** a measure of heat quantity.

THERMAL—Of or pertaining to heat.

VACUUM—A condition of pressure less than atmospheric pressure. Vacuum can be measured in psi, but is more commonly measured in inches of mercury (Hg). A perfect vacuum is 29.92 inches of Hg. This is based on the fact that a perfect vacuum above a column of mercury will support the column to a height of 29.92 inches.

RESISTANCE—The opposition offered by a substance or body to the flow of electrical current.

GLOSSARY OF TERMS

RHEOSTAT—A device which uses a wire-wound variable resistor to increase or decrease current flow in a circuit.

SENSOR STRING—In the electrical sensor ATC system, the circuit which contains the temperature control slide rheostat, the in-car sensor and the ambient sensor.

SOLENOID—A wire coil with a movable core which changes position by means of electromagnetism when current flows through the coil.

STETHOSCOPE—A device used by mechanics to listen for sounds within a component.

SUCTION THROTTLING VALVE (STV)—A device which through regulation of evaporator pressure, controls evaporator temperature to prevent freezing of the core which would result in a loss of cooling capacity.

SUN LOAD—Pertaining to heat caused by the Sun.

TEMPERATURE-SENSING BULB—A small bulb-shaped metal container holding a gaseous substance which reacts (expands or contracts) to temperature changes.

THERMAL—Of or pertaining to heat.

THERMISTER—A resistor-like device, the resistance value of which changes in a pre-determined manner with temperature.

TRANSDUCER—An electrically actuated vacuum regulator.

UPSTREAM BLOWER—A blower mounted near the A/C-Heating system's intake and which pushes air through the system.

VACUUM—A condition of pressure less than atmospheric pressure. Vacuum can be measured in psi, but is more commonly measured in inches of mercury (Hg). In a near perfect vacuum, it is 29.92 inches of mercury at sea level.

VENTILATION—The process by which fresh air is caused to circulate, so as to replace impure air.

VENTURI—A restriction placed in a line where a fluid or a gas is flowing to create a low pressure area past the smallest diameter of the restriction.

VOLTMETER—An instrument for measuring the differences of potential between different points of an electrical circuit.

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